NATIONAL MUSEUM OF VICTORIA

THE JOURNAL of The Department OF AGRICULTURE

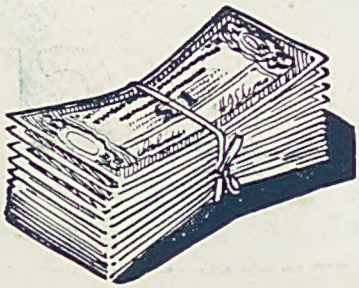
VICTORIA · · · AUSTRALIA

Vol. XXXV.—Part 7. JULY, 1937. PRICE, 3D.

Registered at the General Post Office, Melbourne, for transmission by Post as a Newspaper

Save in the SPRING

Spray in the WINTER



"VALLO" OVICIDAL WINTER WASH

Applied in Winter—during dormant period of trees—definitely kills all aphid eggs.

100% EFFECTIVE

"Vallo" Ovicidal Wash controls San Jose, Red Spider, and kills pupae in the ground.

With "VALLO" OVICIDAL ....WINTER WASH

VICTOR LEGGO & FARMERS LTD., 222 Queen Street, Melbourne, C.1
Phone: Central 1243. G.P.O. Box 508 H

WEED, SCRUB, and TREE KILLERS

"VALLO" PENTOXIDE
LIQUID 36% As_2O_5
GRANULATED 84% As_2O_5

=

ARZEEN
LIQUID 48% As_2O_3
POWDER 80% As_2O_3

Highly Concentrated Preparations of

SOLUBLE ARSENIC

READY FOR IMMEDIATE USE

The most effective and economical weed-killers. Eradicates blackberries and all other noxious vegetation. Completely kills useless timber and prevents growth of suckers.

Supplies Obtainable All Stores. *Write for Particulars, Dilutions, &c.*

VICTOR LEGGO & FARMERS LTD.

Phone: Central 1243 **222 Queen Street, Melbourne, C.1** G.P.O. Box No. 508 H

NATIONAL MUSEUM OF VICTORIA

Contents.

JULY, 1937

		PAGE
Wangaratta Fodder Conservation Competition	*C. P. Goulding, B.Agr.Sc.*	313
Tomato Variety Investigation, 1936–37	*Basil Krone*	317
Entero-toxaemia (Pulpy Kidney) of Sheep and Lambs		322
Pullorum Disease	*H. E. Albiston, D.V.Sc.*	323
The Sheep Nasal Bot	*Compiled by Veterinary Staff*	328
Johne's Disease	*R. J. de C. Talbot, B.V.Sc.*	329
Transport of Pigs—Need for Careful Handling		331
Avian Tuberculosis (Tuberculosis of Birds)	*Compiled by Veterinary Staff*	332
Butter Production and Export		334
Bacterial Spoilage—A Sweet Wine Disease	*D. G. Quinn*	335
The Stock Foods Act—Foods and Licks Registered for 1937	*W. R. Jewell, M.Sc.*	338
Orchard and Garden Notes		346
Professional Papers—		
Irrigation of Sultanas in the Swan Hill District	*F. Penman, M.Sc., J. K. M. Skene, M.Agr.Sc., and D. V. Walters, B.Agr.Sc.*	348

Issued under the direction of the Hon. E. J. Hogan, M.L.A., Minister of Agriculture.

COPYRIGHT PROVISIONS AND SUBSCRIPTION RATES.

The Articles in the Journal of the Department of Agriculture of Victoria are protected by the provisions of the Copyright Act. Proprietors of newspapers wishing to republish any matter are at liberty to do so, *provided the Journal and author are both acknowledged.*

The Journal is issued monthly. The subscription, which is payable in advance and includes postage, is 3s. per annum for the Commonwealth and New Zealand, and 5s. for the United Kingdom and Foreign Countries. Single copy, Threepence. Subscriptions should be forwarded to the Director of Agriculture, Melbourne, C.2.

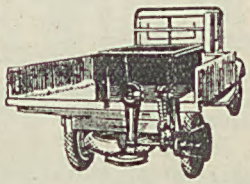
POSTAGE RATES.

The postage required for this issue is:—To Australia and New Zealand, 1d.; to United Kingdom via France, 2d.; to United Kingdom via All-sea route, 1d.; to other British Possessions, 2d.; to U.S.A. and Foreign Countries, 3d.

— SEASONAL EQUIPMENT —

BROADCAST SPREADER

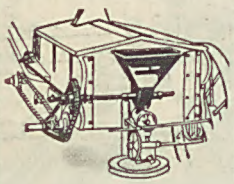
Entirely Self-contained Hopper will hold three or more bags. Has a distributing range of thirty-five feet: will cover a large area each day. Anywhere a horse can go this machine will follow. Specially designed for Rough and Stony and Conditions. Readily convertible to a handy Farm Cart. Grass Seeder can be attached.



BROADCASTER UNIT

Adapted to fit to rear of Motor Truck.

Easily attached and simply operated. Farmer's model holds two bags. Contractor's model holds three bags. Distributor gears enclosed in oil bath. Seeder Attachment available if required. Spreads upwards of 35 feet. Positive feeding assured.



Showing Seed Sowing attachment for Clover, Millet, Lucerne, Rape, etc. The seeding can be done simultaneously with the Broadcasting or sown separately if desired. Adjustments can be made to allow of heavy or light sowing.

HOPPER SPREADER

Single Machines for Horse Haulage.

Coupled Machines for Motor Truck.

A sure, even Sower. Double-gear drive on 9-ft. and 12-ft. widths. Star feed the only positive method of obtaining reasonably accurate quantities per acre.

A special 6-ft. width for Orchardists.

Will sow Lime, Gypsum, or any other Fertilizer, in large or small quantities.

HOPPER SPREADER FOR MOTOR TRUCK

Spreads evenly 16-ft. width at a speed from 10 to 15 miles per hour. Simple right and left hand worm feeds from centre ensure even distribution. Hopper is rigidly stayed and trussed and provided with safety rails for the man feeding.

See Local Agent or Write for Catalogue and Prices.

T. ROBINSON & Co. Pty. Ltd.

Head Office and Works: SPOTSWOOD, W.14, Victoria
Show Rooms: 536-538 BOURKE ST., Melbourne, Victoria
Sydney Depot: RAILWAY PARADE, BURWOOD, N.S.W.

INDEX TO ADVERTISEMENTS

FRONT SECTION

General Motors-Holdens Ltd. (Chevrolet Trucks) viii

Goodyear Tyres ... ... opp. p. 320

International Harvester Coy. of Australia Pty. Ltd. (Separators) v

Law Somner Pty. Ltd. vii

Leggo, Victor, & Farmers Ltd. ... inside cover

McKay Massey Harris Pty. Ltd. iii

Robinson, T. & Coy. Pty. Ltd. ii

Rylands Bros. (Aust.) Ltd. vi

State Savings Bank vi

Stud Breeders' Cards iv

Trewhella Bros. Pty. Ltd. iv

Vacuum Oil Coy. Ltd. ... ... opp. p. 321

BACK SECTION

Australian Cement Ltd. ... ... inside cover

Clydesdale Stallion and Colts for Sale opp. p. 356

Cockbill, J. ix

Friesian Bull Calves for Sale xv

Lysaght Bros. & Coy. Ltd. x

McGregor Wheel Grip and Engineering Pty. Ltd. ... ... outside cover

Red Poll Calves for Sale xi

Victorian Railways xii

Wills, W. D. & H. O. (Aust.) Ltd. ix

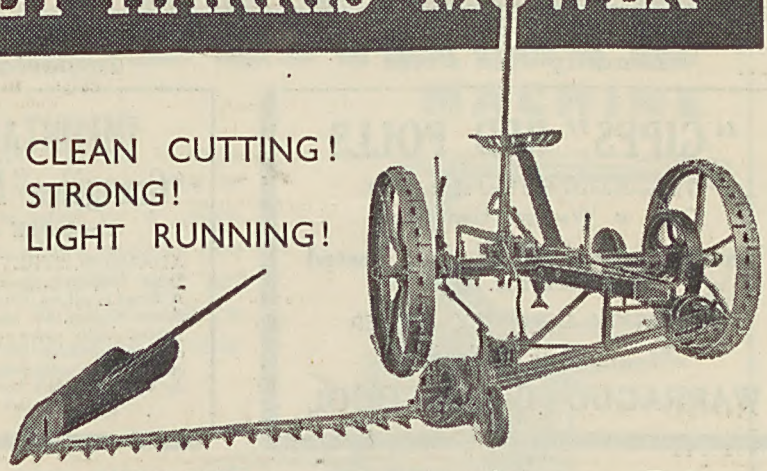
FARMERS EVERYWHERE HAVE PROVED IT TRUE!

CLEAN CUT SUPERIORITY IN THE MASSEY HARRIS MOWER

A TYPICAL EXPERIENCE

Mr. H. E. Pugsley writes that after 8 years' use, cutting all conditions of crops, his Massey Harris Mower is good for many more seasons of perfect service. Other letters report excellent service for 25 years and more.

CLEAN CUTTING!
STRONG!
LIGHT RUNNING!

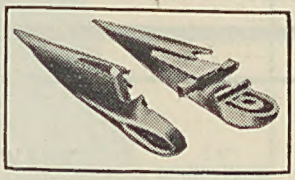


The CUTTER-BAR is the most important part of any mower. This is so fully recognized by H. V. McKAY MASSEY HARRIS that they depart from ordinary manufacturing methods and adopt high motor-engineering practices.

Showing Complete Cutter-bar

Unusual features include—

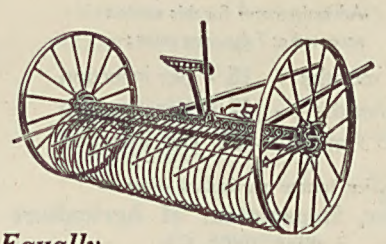
- Using converter steel for the fingers and milling to precision finish.
- Using high spring steel cutter-bar, finely milled.
- Machining and lining knife-bar exactly to give a free moving knife and a perfectly lined cutting surface over which the knife passes.
- The STREAMLINED fingers of convertible steel penetrate any crop easily.
- The design and material provide strong fingers that retain their position. Interchangeable; replaceable.



- They are cleverly shaped to give even mowing over any ground, rough or smooth.
- The cutter-bar is hinged to enable it to follow uneven ground.

These and many other features make Massey Harris Mowers supreme for clean cutting, easy running, and long life. 1-horse and 2-horse models, 3½ feet to 6 feet cut. Many ingenious attachments available, including twin guard low-cut bar for golf links, parks, gardens, &c.

Ask your local agent for the special Mower Catalogue, or write direct.



Equally Superior in its field is the

MASSEY HARRIS HAY RAKE

Strong, light running. Oil-tempered ½-inch teeth of high carbon spring steel. Spring-back coil. 8-ft. wide x 30 teeth, and 9-ft. wide x 34 teeth, for Hay; also 8-ft. wide x 20 feet, for Trash. One-horse shafts or two-horse pole.

H. V. McKAY MASSEY HARRIS PTY. LTD.

SUNSHINE HARVESTER WORKS, SUNSHINE, W.20, VIC., Also at Melbourne, Sydney, Adelaide, Perth, & Brisbane

Stud Breeders' CARDS

Leading Red Polls

"GIPPS" RED POLLS

The well-established herd of Red Poll Cattle at Warragul High School.

Young Bulls, Heifers, and Tested Females for Sale.

INSPECTION CORDIALLY INVITED.

Inquiries to the Head Master,

WARRAGUL HIGH SCHOOL

Important Jersey Sale

IMPORTANT SALE of the "Grangelea" Proven Reg. Jerseys

On behalf of Mr. A. A. Broad

ADAMSON, STRETTLE & Co. Pty. Ltd., 396 Bourke Street, Melbourne, have received instructions from Mr. A. A. Broad to sell, on Thursday, 28th October, at "Grangelea," Sutton Grange, 70 head of high-class Government-tested Jerseys, mostly young cows and 2-year-old heifers, due to calve in September and October. Balance will be young cattle. Jersey enthusiasts will welcome this announcement, as the Herd is widely known. Catalogues will be available later on application.

Poultry

WHITE LEGHORN

Chickens and Eggs

From selected well-bred hens mated to cocks bred from tested stock.

PARTLY-REARED CHICKENS	£5 per 100
DAY-OLD CHICKS ..	£4 per 100
HATCHING EGGS ..	£1 10s. per 100

Delivery from August onwards. Satisfaction guaranteed.

L. MAGNUSSON, Private Bag, NATHALIA

Advertising Rates

STUD BREEDERS' CARDS

Advertisements for this section accepted at following rates :—

12 months - **15/-** per insertion
6 months - **17/6** per insertion
1 to 3 months - **£1** per insertion

For further particulars write to

Director, Department of Agriculture
MELBOURNE, C.2.

Is a simple arrangement that multiplies the power at the handle 260 times—handy to use, easy to move, quickly rigged, and works in roughest country. Standard equipment pulls trees and stumps from 1½ acres without changing anchor. Many other time- and labour-saving features. Catalogue with pleasure.

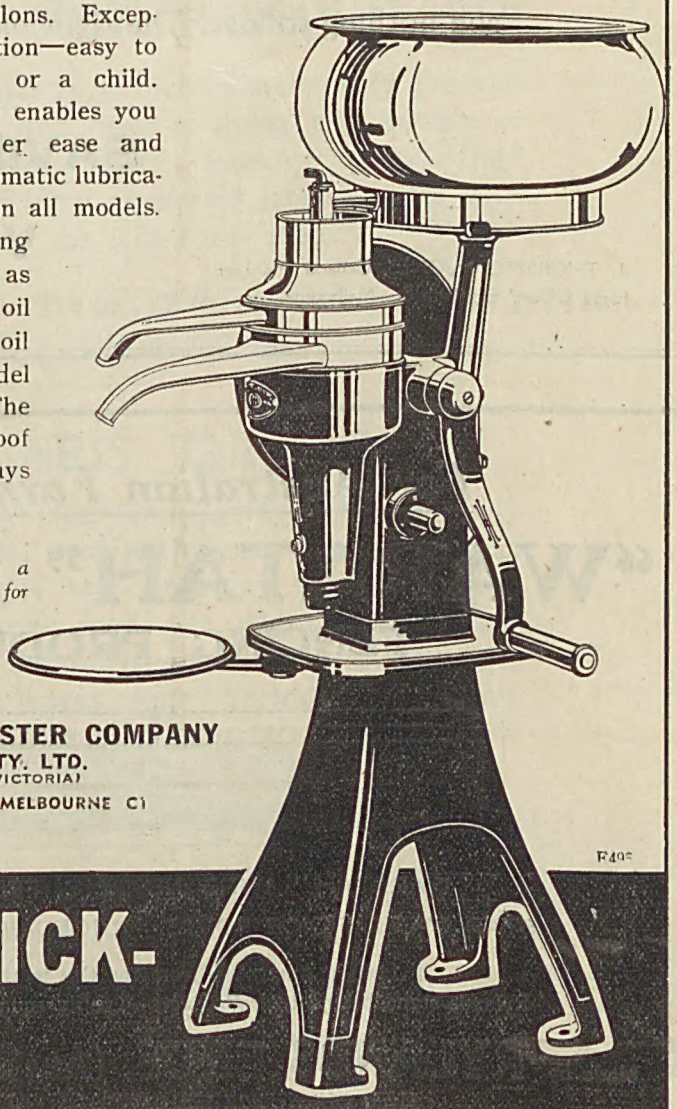
TREWHELLA BROS. PTY. LTD., TRENTHAM

EVERY

McCORMICK-DEERING CREAM SEPARATOR IS A GENUINE BALL-BEARING MACHINE

Six sizes—35 to 150 gallons. Exceptionally smooth in operation—easy to turn even for a woman or a child. Here is a machine which enables you to separate with greater ease and greater efficiency. . . . Automatic lubrication system is provided on all models. Every bearing and running part is thoroughly oiled as machine operates; worn oil is forced out when fresh oil is added. . . . Every model has stainless steel discs. The discs are stainproof, rustproof —easy to keep clean, always retain their shape.

Ask your local agent to bring a McCormick-Deering to your farm for a demonstration.



INTERNATIONAL HARVESTER COMPANY
OF AUSTRALIA PTY. LTD.
(INCORPORATED IN VICTORIA)
543-555 BOURKE STREET, MELBOURNE C1

McCORMICK-DEERING

THE PRACTICAL MAN
MAKES AN EARLY START

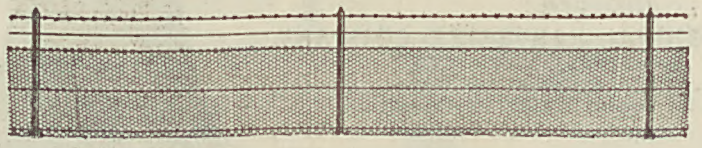
WISHING that you were lucky enough to be wealthy is of no practical value in building up your bank account. The only reliable way to independence is to save systematically. Make an effort to start ; the result will be well worth while, for you have everything to gain, and nothing to lose. The right place for your savings is—

THE
STATE SAVINGS BANK OF VICTORIA

J. THORNTON JONES, General Manager
Head Office : Elizabeth St., Melbourne.

For Australian Farmers . . !

"WARATAH" BRAND
FENCING PRODUCTS



"WARATAH" WIRE NETTING, FENCING WIRE,
STAR STEEL FENCE POSTS, HINGED-JOINT FENCE, ETC.

100% Australian from the Ore to the Fence.
Rylands stand behind their Products—Quality equal to any in the World.

Made by **RYLANDS BROS. (Aust.) PTY. LTD.** Newcastle (N.S.W.)
Head Office: 422 Little Collins Street, Melbourne

SEEDS

TALLAROOK LATE STRAIN GOVERNMENT CERTIFIED SUBTERRANEAN CLOVER

A very leafy strain, which makes rapid growth in the Spring, and flowers about the middle of October. Gives later feeding than other varieties. An ideal strain for late districts, and also for irrigation areas.

PRICE—In sealed bags—2/4 lb., 28 lb. at 2/3 lb., 56 lb. at 2/2½ lb., 1 cwt. at 2/2 lb.

PHALARIS TUBEROSA

An excellent Winter and Spring-growing, truly perennial grass, will withstand severe frost as well as drought and provides three to four cuts of succulent feed per year. Our strain of Phalaris Tuberosa is noted for the abundant bright green leaves, long period of vigorous growth and large fibrous root system.
Sow 3 to 4 lb. per acre.

PRICE—4/6 per lb.

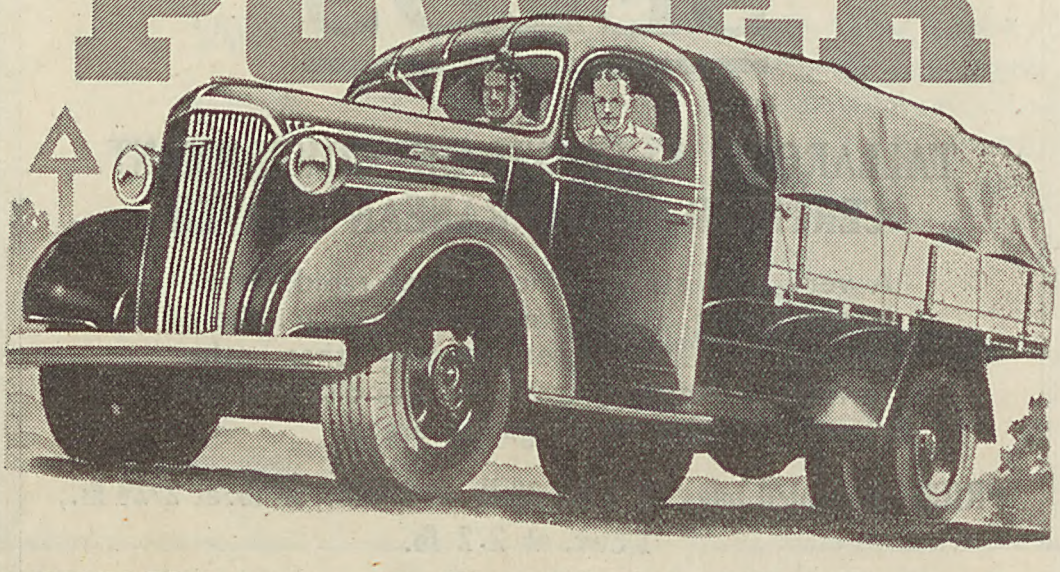
FREIGHT PAID—For cash with order of £2 and over we will pay freight (goods train) to any Station in Victoria, also on Interstate cash orders of £5 and over.

For Perfect Pastures Sow Seed from

LAW SOMNER PTY. LTD.

21-23 ELIZABETH STREET, MELBOURNE, C.1

Economical POWER



CHEVROLET brings you the Biggest Output of Real Working Power of any Truck in its Capacity Class Irrespective of Price.

Full power at the speeds you need it. From the starting of a capacity load, up to a maximum safe cruising speed, the new 1937 Chevrolet brings you higher power with greater economy. This pulling power and economy is yours because Chevrolet's engine has been made more efficient and is the finest power plant ever placed in a truck of its capacity class irrespective of price. See these great new trucks at your local dealer's. Try one out on the road under your own road and load conditions.

NEW CHEVROLET FEATURES—

New Higher power 6-cylinder Overhead-valve long-life Engine ... New Four-bearing Crank and Camshafts ... New Cushion-mounted Engine Supports ... New Steering with increased ratio ... New U-type and Box-girder Cross Members ... New Dome-headed, Slipper-skirted, Grey Iron Pistons ... New Downdraught Carburetion ... Oil Bath Air Cleaner ... New Steelstream Styling ... New Full Floating Back Axle ... Improved Hydraulic Brakes.

GENERAL MOTORS-HOLDEN'S LIMITED

Easy to Buy under Confidential G.M.A.C. Plan of Deferred Payments

Your Money Goes Farther in a General Motors Product.

Six Cylinder **CHEVROLET** Long Life

CHASSIS PRICES:

Commercial Truck ...	from £230
30-cwt. Truck (131 in. w.b.) ,,	£277
2-ton Truck (157 in. w.b.) ,,	£297

(All Prices Plus Sales Tax)

Sold and Serviced by Chevrolet Dealers Throughout Australia.

FREE—Do you keep really accurate costs of running your truck? Send for copies of Simplified Cost Operating Book Free on request.

Name.....

Address .....

General Motors-Holden's Ltd., Box 1714, G.P.O., Melbourne

C.36

CONSULT YOUR LOCAL AUTHORIZED CHEVROLET DEALER

NATIONAL MUSEUM OF VICTORIA

The Journal of the DEPARTMENT of AGRICULTURE of VICTORIA

Cutting meadow hay.

Wangaratta Fodder Conservation Competition

Report of the Judge—C. P. Goulding, B.Agr.Sc.

A FEATURE of the Competition conducted by the Wangaratta Agricultural Society was the large amount of fodder conserved by all of the competitors, while the variety and quality of fodder exhibited indicated that district farmers are paying increased attention to this very important aspect of stock-raising. Many of the farms visited were situated in areas of favorable rainfall and good soil conditions, so that farmers were enabled to grow maize for silage, root-crops and lucerne, in addition to well improved annual and perennial pastures.

It was pleasing to note that five of the seven entries included silage, although, in the case of silage stacks, a good deal of loss had occurred. It is generally being recognized that the making of silage in trenches results in more efficient handling with a minimum of waste, and judging from discussions with farmers who have used both trench and stack methods, it is reasonable to expect that in future the former will be used almost exclusively. Several competitors had taken advantage of natural slopes in choosing suitable sites for trenches, thus providing for good drainage and for ease in removing the material. Further advantages of the trench method will become obvious when the use of sweep-rakes in gathering the material directly behind the mower becomes more general.

A good deal of variation was noticeable in the quality of pasture hay, chiefly in respect to maturity, curing and damage by rain. Those who

Cutting and raking a silage crop.

have handled, in one season, relatively large quantities of pasture hay, realize the great difficulty in conserving all of it in good condition. However, it appears that much of the hay is cut at a rather advanced stage of maturity, or is over-cured, and it is probable that, unless ample equipment and labour are available to handle the hay as required, it would be wise to increase the relative amount of silage made. Cutting for silage can be started early in the season, and no trouble is experienced due to weather conditions.

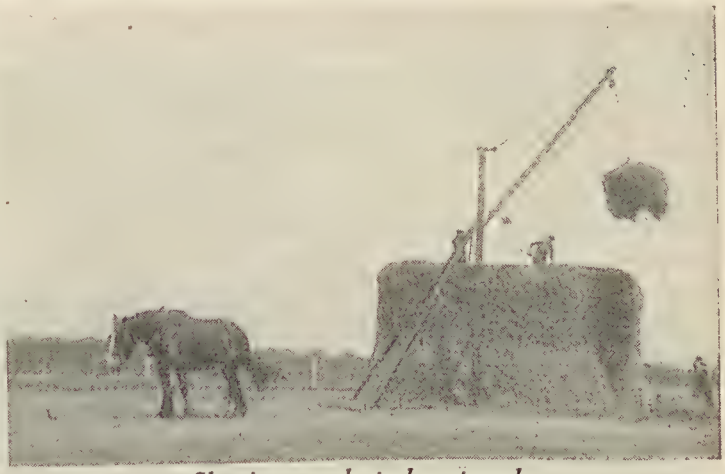
In recent years, much damage to hay has been caused by bad weather during harvesting after stacking. Efficient methods of protection for pasture hay stacks will become increasingly urgent as these stacks are built in the field with bulk-handling equipment. Many farmers have already given this matter a good deal of thought, but no standard method has yet been adopted. A suggestion which should prove practical and economical is the use of a sectional galvanized iron roof on a stack of rectangular section. A stack of this shape would prove more efficient than the ordinary type in that a greater amount of material could be put on a given base. As each bench was removed from the stack, a roof section could be removed and used elsewhere.

Five of the seven competitors held reserves in excess of requirements as stipulated, while the reserves of the remaining two were only slightly below requirements. Two competitors each held more than 400 tons of various fodders, on farms of approximately 400 acres. Mr. A. H. Cook of Milawa, although holding relatively less than several others, had paid particular attention to the quality of fodders, his lucerne hay, lucerne chaff, and trench silage made from first cut of lucerne, being particularly good.

First prize was awarded to Mr. H. Walker of Barwidgee, who has been working a very attractive farm of 400 acres, which has recently been increased by the purchase of a further 300 acres. Although Mr. Walker acquired the property in a relatively unimproved state about nine years ago, he has made remarkable improvements in subdivision and pasture improvement, at the same time conserving more than 400 tons of fodder, including pasture hay, oaten hay and chaff, and silage. The chief drawback to an otherwise excellent exhibit was the inadequate protection of a number of pasture hay stacks, some of which were seven years old. Mr. Walker, however, is considering the best means of overcoming this problem, and, if this is accomplished satisfactorily,

his method of conserving fodder at various selected points on the farm should prove very effective.

The farm is devoted mainly to dairying, approximately 130 head of cattle, of which more than half are milking cows, being carried. In addition, upwards of 100 sheep are maintained or fattened. This relatively high carrying capacity, with excellent figures for butter-fat production, and the conservation of such large amounts of fodder are a tribute to the productiveness of the farm and to the efficiency of the owner.



Showing a grab stacker at work.

Mr. W. L. Tetley of Oxley, who secured second prize, is engaged in dairying and sheep-raising. His total reserves amounted to more than 400 tons, including lucerne and clover hay, oaten hay and chaff, and trench silage. Mr. Tetley has made a particular study of the best means of conserving fodders, and his exhibit consisted of good quality materials handled and stored efficiently. All fodders were conserved adjacent to the homestead, but as the paddocks used were not far distant, no great distance was covered in storing. A very large stack had been erected with bulk-handling equipment, including overhead gear consisting of pulleys and cable. This method makes it possible to build efficiently a very long stack. In choosing a site for the trench silo, Mr. Tetley made use of a natural bank, which greatly facilitated removal of the material, and at the same time provided effective drainage.

The winner of the third prize, Mr. W. J. O'Brien of Hansonville, is also a keen student of the various aspects of conservation. His exhibit provided the greatest range of fodders, including clover and grass hay, lucerne and oaten hay, lucerne and oaten silage in stacks, maize silage in trenches, and peas as grain. In addition to this, small areas are devoted to maize for green feed and to pumpkins. The conserved fodder amounted

A type of meadow-hay sweep which has been found efficient on many farms.

to more than 200 tons, which is very high considering the size of the farm, 160 acres.

Mr. O'Brien's exhibit was marred to some extent by the damage to grass hay stacks, although portion of this damage was due to unfavorable weather during harvesting. Mr. O'Brien favours the method of storage at different points on the farm, and it appears that, as in the case of Mr. Walker, the success of this method will be largely influenced by the provision of adequate and economical protection. On many farms the method has such advantages that a good deal of expense in providing efficient covering would be justified. Mr. O'Brien is giving much thought to the provision of a varied and palatable ration for his stock, and to efficiency in harvesting and feeding. The high yields per acre which he obtains considerably reduce the harvesting expenses per ton. On the 160 acres, he carries about 60 head of cattle, of which 45 are milking cows.

Mr. W. B. Richardson of Docker's Plains was the only competitor who favored the baling of pasture hay. Mr. Richardson is strongly in favour of this method under his conditions, but it is improbable that it will become widespread on the ordinary dairy farm. The various methods of handling and storing can often be determined only by a close study of the conditions on any particular farm.

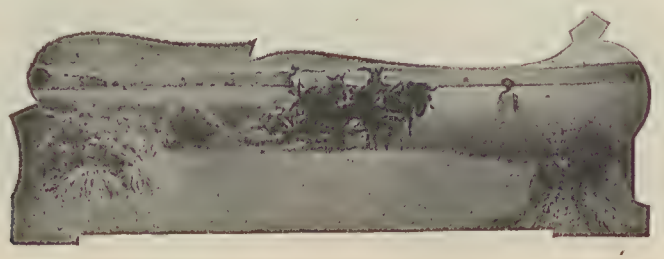
Mr. A. Wighton of Springhurst, whose reserves consisted chiefly of oaten hay, and Dr. J. L. and Mrs. E. Henderson of Milawa, whose exhibit included a range of fodders, were at a disadvantage on account of not having excess fodder on hand.

The exhibits were generally of a high standard, and the enthusiasm with which competitors discussed the various problems connected with conservation indicates that a still higher standard may be expected in the near future. Two aspects in which a good deal of improvement may be expected are methods of handling and the provision of protection, especially for pasture hay.

The problem of making the utmost use of all materials grown on the farm is one of the most important aspects of efficient stock-raising, and is intimately bound up with a solution of the difficulties encountered in fodder conservation. It may confidently be expected that the dissemination of knowledge by means of these competitions will be of inestimable value in this regard.

WANGARATTA FODDER CONSERVATION COMPETITION.

Competitor.	Suitability and Quality of Fodder.		Location and Protection.		Economy of Production including Production, Storage and Feeding Cost.	Carrying Capacity when improved and under Natural Pasture.	Quantity of Fodder in excess of requirements on pro rata Basis.	Total.
	Suitability of Fodder.	Appearance, Palatability and Nutritive Values.	Location of Site re Fire, Flood, Economy in Feeding and General Access.	Protection from Weather, Pests, Stock, Fire and Deterioration.				
Possible Points	30	35	10	20	20	35	50	200
H. Walker	28	31	9	15	18	35	50	186
W. L. Tetley ..	28	32	9	17	18	35	26	165
W. J. O'Brien ..	27	30	9	16	18	35	24	159
W. B. Richardson ..	26	31	9	17	17	35	23	158
A. H. Cook	28	33	9	18	18	35	5	146
A. Wighton	27	32	9	17	17	32	..	134
Dr. J. L. and Mrs. E. Henderson ..	28	32	9	17	18	30	..	134



Tomato Variety Investigation 1936-37

By Basil Krone, Chief Packing Instructor.

Tomato Growing at Keilor.

EVERY year the continued multiplication of tomato varieties causes much confusion and loss of money to tomato growers who are ever seeking to find some variety more suitable to their district, and one which will be more or less free from general tomato diseases and disabilities. With a view to assisting in this objective an investigation as to the suitability of certain varieties, especially in relation to cropping, and to districts was begun in 1935, and continued during the past season.

Seed of six varieties was supplied by the Department of Agriculture, New South Wales, through its special officer, Mr. H. A. Douglass. In addition seed of six other varieties was purchased, and seed of one new variety, San Mazano, was donated by Messrs. Panlook Bros., Eurobin.

The observations made on the growth and cropping ability of these varieties, with special reference to the 1936–37 season, are set out below. It is interesting to note that some of the varieties which have proved so satisfactory in New South Wales were a complete failure under our cool southern conditions. Some, however, will remain as an acquisition to the industry, even supplanting some of the older varieties.

Each variety tested was submitted to heavy, medium, and light systems of pruning. The varieties tested and the results obtained are set out below.

Australian Earliana.—This medium to light cropper was tested in all districts but proved to

Showing a tomato planting machine at work in the Eurobin district.

be quite useless under Victorian conditions. It is subject to splitting and softens badly at the ripening period.

Bonny Best.—This variety cannot be recommended. It is a medium cropper and good carrier when planted late in southern districts, but is inclined to run small. In northern districts it is useless as an early variety. It softens badly at ripening period and is a poor carrier.

Beefsteak.—A good quality tomato but a poor cropper. It is mis-shapen, is very subject to cat-faces ("Cat-face" is a term used to describe a rough, irregular surface, more or less corrugated and uneven); is subject to blossom end rot, and splits badly everywhere it is grown.

Selected Recruit—a variety very similar to Market King (see below).

Kondine Red.—This excellent variety has proved to be a good cropper of first-class quality, and is satisfactory as a late variety in all our southern districts. It will be grown over a wide area when better known.

Keystone.—A useless type, similar to Beefsteak in undesirable features.

Red Marhio.—A tomato of quality and good to medium cropping habit. It is as round as a ball

The variety Market King which is still regarded as suitable in the Keilor, Portland and Wangaratta districts.

Growing tomatoes in unheated glasshouse conditions—Echuca district.

and gives every satisfaction. An excellent variety which is sure to be popular in this State.

Of the above varieties, Red Marhio and Kondine Red are being retained. They are first-class late varieties. Information with regard to the behaviour of these varieties in our northern districts, where it is possible they may behave differently, is not available at this stage.

In Victoria, first-class *round late* varieties are available, but there is a dearth of good *round early* tomatoes. More of the latter type would improve the industry considerably.

A pleasing feature of Kondine Red and Red Marhio in the tests was their value from a commercial point of view. They were profitable to grow in the bush form; also whether lightly, medium, or heavily pruned on stakes. From observations, however, it is suggested that they be grown as staked varieties and pruned to a single leader, but to not more than three leaders.

The following varieties were tested from seed obtained locally:—

Market King.—This variety is a cluster type which must be heavily pruned and forced. It is inclined to run small and is subject to splitting.

San Mazano—A suitable sauce variety which has proved a good cropper in all parts of the State.

A very good cropper but, although of a round shape, it is not of the best quality. Growers in the Keilor, Portland, and Wangaratta districts continue to plant it, but elsewhere it is being discarded.

Ailsa Craig.—A very good cropper, but the fruit is too small.

Abundance.—A heavy cropper of exceedingly low quality fruit, of no flavour and no substance.

Selected Recruit.—This variety is very similar to Market King in appearance and characteristics, in fact it is difficult to distinguish between the two.

Eccles Surprise.—A good round-shaped tomato which is a satisfactory cropper of excellent quality. Best results are obtained when it is lightly pruned, but it should be staked. It can be confidently recommended for all southern districts. Eccles Surprise may become the main variety in the Bacchus Marsh and Croydon districts. It is a first-class late variety, but unfortunately in some of the northern areas is inclined to softening at the ripening period.

Frogmore.—A variety which has been tested in the Portland district with every satisfaction. Medium pruning appears to suit it and it should

ROUND-SHAPED VARIETIES.

Variety.	Method of Pruning Recommended.	Habit of Plant.	Cropping Ability.	Average Size of Fruit.	Quality.	Remarks.
				Inches.		
Crimson Bell ..	Either on stakes or in the bush form	Medium ..	Good ..	2¼ to 3	Fair; suitable local markets	Does well as early or late variety, but is not suitable for long distance transport
Eccles Surprise ..	Prune lightly, or not less than three leaders on stakes	Tall ..	Good ...	2¼ to 3¼	Good; sweet flavour, solid flesh	Does well with little or no pruning. Is an advantage to tie whole bush up. Only suitable as late variety in cool districts
Frogmore	Heavy pruning causes splitting	Medium ..	Good ..	2¼ to 2¾	Good; sweet flavour. More watery than Eccles Surprise. Good local market variety	Very sensitive to location. Splits badly on low-lying wet soils. First class on well-drained land
Kondine Red ..	Prune medium; one to three leaders on stakes	Medium ..	Good ..	2¼ to 3	Good flavour; not watery	This variety is doing well and should become popular when known
Low Branch ..	One or two leaders on stakes	Semi-dwarf	Medium ..	2¼ to 3	Good solid flesh	One of the best for long distance transport when grown as a late variety
Sensation	Single leader on stakes	Tall ..	Good ..	2¼ to 2¾	Poor, somewhat acid, but good seller on account of appearance	Suitable as a late variety in the southern and coastal districts. Very largely grown in the Portland area
Market King ..	Prune heavily to single leader on stakes	Tall ..	Good cluster type	1 to 2¼	Not the best; watery	Inclined to run small. Only useful when heavily forced under market garden conditions. Splits frequently
Recruit	Prune heavily to single leader on stakes	Tall ..	Good cluster type	1 to 2¼	Not the best; watery	Difficult to distinguish from Market King
Red Marble	Single or double leaders on stakes	Medium ..	Fair to medium	2¼ to 2¾	The very best for canning or dessert	A beautiful tomato of quality; round as a ball. A good seller
John Baer	One, but not more than three leaders on stakes	Medium ..	Medium to light cropper	2¼ to 3	Good canning quality	Suitable only as a late variety in southern districts. Sometimes subject to cat-face and blossom-end rot
Heterosis	One, but not more than three leaders on stakes	Medium ..	Good cropper	2¼ to 3	Good quality and flavour	An excellent late variety. Splendid shape. Remains firm at the ripening stage. Is not subject to cracking or splitting
Britain's Best ..	Single leader on stakes	A cluster type of medium to tall growth	Good ..	2 to 2¾	Good for local market, but not canning quality	One of the few varieties that succeeds in a glass-house. Must be forced, otherwise small fruits develop

FASTER WORK BETTER WORK MORE PROFITS

In the space of three years, farmers' enthusiasm for "air tyres" has replaced scepticism; they can do more work—better; their tractors are more adaptable, more profitable.

To-day, the new Goodyear All-Way-Traction Tractor Tyre enjoys an outstanding preference throughout Australia. This is the ONLY tractor tyre with maximum grip and pulling power—forwards, backwards AND sideways. Result—more power, more top-gear work, greater fuel economy, lower operating costs!

Its flatter, wider tread, thicker, deeper, diamond blocks and heavy sidewall bars give 50% more traction, 30% more drawbar pull, and 100% more shoulder grip to prevent side-slip.

GOODYEAR-IZE YOUR FARM

There's the right Goodyear Belt for all your stationary work. There's the right Goodyear Tyre for your car, your truck, and your farm machinery, for instance—

BINDER—COMBINE—MOWER—SPRAYER—FARM WAGGONS—HAY PRESS—HEADER—CULTIVATOR—THRESHER.

THE NEW GOODYEAR ALL-WAY-TRACTION TRACTOR TYRE

TERMS!
Goodyear Tractor Tyres and Wheels are available on Hire Purchase Terms. For particulars write the Goodyear Branch (all capital cities).

SEND FOR INTERESTING LITERATURE
on the advantages of pneumatic tyres for tractors and farm machinery.
Goodyear Tyre & Rubber Co., 23 Therry St., Melbourne.

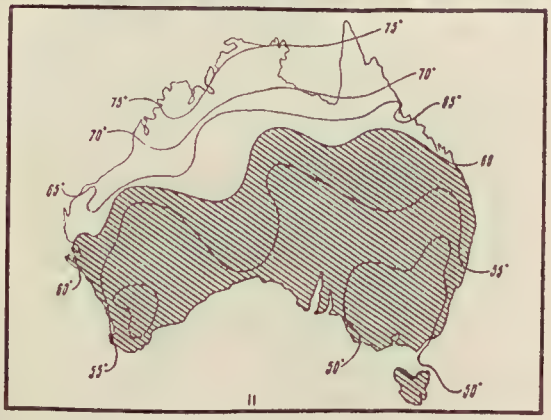
Name & Address: .....

..... AM77

10-16-37.

FINAL WARNING TO MOTORISTS

Cold weather gives most cars "indigestion." You press the starter. It coughs! You choke it. There's a strangled gurgle and silence! Such sufferers NEED the Correct Winter "Diet"—with Super Plume Ethyl and the correct Winter grade of Mobiloil (used TOGETHER, mind you) you will be absolutely amazed at the Split-second coughless Starting, the knockless full-powered response, and an all-round performance and economy that will be a revelation to you!



If you operate a motor vehicle in shaded area, remember, low temperatures demand a change to a highly volatile spirit (Super Plume Ethyl) and a lighter-bodied winter grade of oil (Mobiloil). Make the change and get superlative Winter Performance.

CHANGE NOW TO

SUPER PLUME ETHYL

AND

WINTER GRADE

Mobiloil

FLAT-SHAPED VARIETIES.

Variety.	Method of Pruning Recommended.	Habit of Plant.	Cropping Ability.	Average Size of Fruit.	Quality.	Remarks.
				Inches.		
(*a*) Wilding's Prolific ..	Usually unpruned in the bush form, but will stand up to heavy pruning and staking	Semi-dwarf	Good ..	2¼ to 3	Poor; watery, somewhat acid flavour	More suitable Goulburn Valley conditions. In the southern coastal area it will not stand up to the continuous harvesting. Can be grown as an early variety
(*b*) Burwood Wonder ..						
(*c*) Velocity						
(*d*) South Australian Dwarf ..						
	(The above four	names repre	sent the same,		or a very	similar variety.)
Orange Prolific ..	Prune lightly or not at all; in the bush form	Tall ..	Good ..	2¼ to 3¼	Poor; sometimes a windbag	Suits all the cooler districts of the State; should be grown as a late variety. A great disease resister
Australian Large Red..	Generally unpruned, in the bush form	Tall ..	Good ...	2¼ to 3½	Poor; watery, somewhat acid	Although a heavy cropper, is safe to say fully 20 per cent. is lost through mis-shapen and cat-faced fruit
Pale Leaf or Yellowtop	For glass house, prune single leader; or in bush form if outside	Medium ..	Good ..	2¼ to 3	Not the best; acid watery	Suitable as an early variety under glass-house or outside conditions. Suits northern districts as well as southern. Will stand any amount of forcing without splitting
Bendigo Special Strain	Grown chiefly in the bush form unpruned	Medium ..	Good ..	2¼ to 3	Solid, but not best quality	An early variety and one of the best commercial flat varieties

be grown on stakes. It is a nice round tomato of good flavour, which suits the Melbourne market, but it is not a good carrier for interstate markets. This variety must be grown on well-drained situations, otherwise it is subject to splitting.

San Mazano.—This new variety is a good cropper in all parts of the State. Unlike other types, it should not be harvested until it is a crimson colour. While not satisfactory as a table variety, this bright red tomato appears to be the

A good round-shaped tomato—Eccles Surprise.

most suitable one available for sauce. It is dry, somewhat mealy, contains very few seeds, has a tough skin, and will not crack under forcing conditions. The San Mazano tomato has very good transport qualities, and will carry satisfactorily from Melbourne to Sydney and Brisbane after being harvested at full red colour. It may be pruned lightly or not at all, or it may be heavily forced on a single leader. The tripod method of staking suits this variety admirably.

The accompanying table shows the characteristics of the best of the varieties just described, as well as other well-known types which have proved suitable in various districts and under varying conditions.

It is recommended that, where possible, round, smooth-shaped types should always be grown. Flat varieties are frequently heavy croppers of poor quality. Round varieties are often poor to medium croppers of good quality fruit, but fortunately this disability is gradually being overcome, while those of flat shape usually bring low prices.

To assist growers who wish to sow an area of a given size, the following counts of tomato seed per ounce should be of assistance when purchasing supplies :—

	Seeds per oz.
Burwood Wonder	10,120
Crimson Bell	9,810
Eccles Surprise	10,700
Market King	11,340
Recruit	9,000

A leaflet on "Packing Tomatoes" is available free on application to the Director, Department of Agriculture, Melbourne, C.2.

Entero-toxaemia (Pulpy Kidney) of Sheep and Lambs

ENTERO-TOXAEMIA affects mainly young lambs up to the age of sixteen weeks which are on good feed and in good condition. However, cases occasionally do occur in aged or store sheep. Sheep or lambs which develop the disease usually die suddenly and are found dead in the camp in the morning, or they may lie down quietly and die in the paddock during the day-time without attracting attention.

On some properties last lambing season the incidence of the disease was high, although on properties where the lambs were vaccinated and other control measures were adopted the mortality was very low.

Recently a comprehensive survey of a large number of properties on which cases of the disease have occurred was carried out by officers of the Live Stock Division of the Department of Agriculture, and, as a result, it has been definitely established that the disease may be controlled and the mortality reduced to a minimum if the lambs are vaccinated and a supply of meadow hay is available at all times.

To be effective, vaccination should be carried out at an early age, the first dose being given when the lambs are two to three weeks old and the second after an interval of from three to four weeks. The vaccine is prepared by the Commonwealth Serum Laboratories, Parkville, from which supplies may be obtained.

Pamphlets on the disease and on the correct method of vaccination of sheep may be obtained free of charge on application to the Department of Agriculture, Melbourne, C.2.

Pullorum Disease

By H. E. Albiston, D.V.Sc., Director, Veterinary Research Institute

BACILLARY White Diarrhoea, or Pullorum Disease, is the most insidious and destructive of all known diseases of poultry, and is said to be responsible for the loss of 10 per cent. of all chicks hatched in the United States of America. It has been present in Victoria for a number of years, and is becoming more common as the poultry industry develops.

Pullorum disease is a specific infectious disease of birds, caused by a micro-organism or germ, the *Salmonella pullorum*. This germ was discovered as the cause of the disease by Rettger and Harvey in the United States of America in 1908: it is a slender rod-shaped form, allied to those bacteria known as the paratyphoid group and can be found in large numbers in the blood and organs of chickens dying from the infection.

Pullorum disease produces the most marked results in young chickens, although the chronic form is a serious condition in the adult fowl, and may be accompanied by a high mortality rate. Other birds are rarely attacked, although baby turkeys are very susceptible and cases are on record of high death rates in turkeys hatched in infected incubators. So far as is known, the disease does not occur in ducks.

Source of Infection.

The course of pullorum disease may be very aptly termed a vicious cycle. It is one of the very few diseases which are actually hereditary, as the causal organism may be present in eggs laid by infected hens. In describing the course of pullorum disease, it is convenient to commence with an infected fertile egg which hatches. The chicken hatching from this egg may have contracted the disease already, but it almost certainly will show a heavy contamination of its down with the germ. As the chick dries in the incubator, small particles of infected down will be found in the air, thus providing the infective material by which its fellows are exposed to infection by inhalation. This point has been adequately proved experimentally, by the placing of artificially infected down in incubators, resulting in infection of the contained chicks.

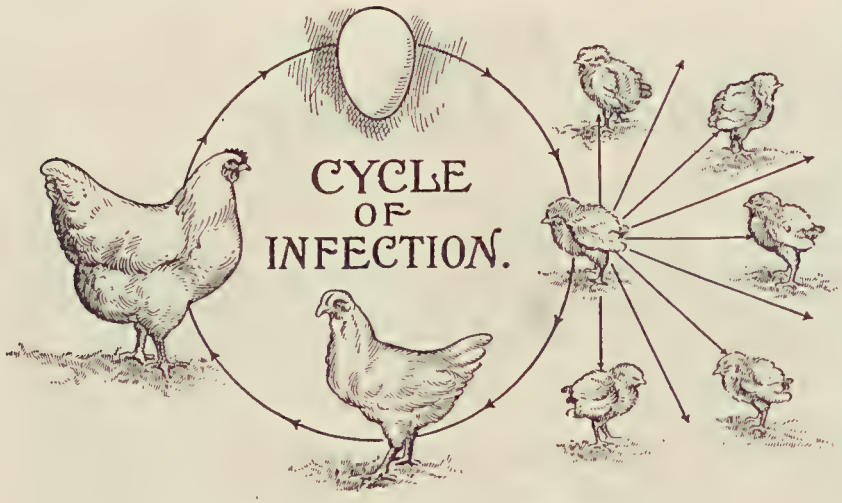
It has also been definitely proved, experimentally, that the hatching of a few infected chickens in an incubator is sufficient to infect healthy chickens hatched in the same incubator. Once the infection commences, the ingestion of infected material is also a means of dissemination from chick to chick.

In this way, an outbreak of pullorum disease in chickens generally starts. Although the disease has a high mortality rate, the fact that some chickens survive is mainly responsible for its perpetuation, for, as will be discussed later, recovered fowls usually show a chronic infection of the ovary, and are liable to lay infected eggs; that is, they become the "carriers." The inclusion of only a few infected eggs in an incubator is sufficient to produce an outbreak of the disease.

To Poultry Keepers

The Department of Agriculture is anxious to help all owners whose stock may be affected by disease. Unfortunately some poultry keepers appear to be disinclined to report cases of notifiable diseases proclaimed under the Stock Diseases Act, apparently because they fear their operations may be hampered by unnecessary restrictions. This attitude is not justified, as any action taken has as its immediate object the benefit of the individual as well as the industry. Where such outbreaks have been reported promptly to the Chief Veterinary Inspector, the advice given frequently has enabled the owner to avoid the heavy economic loss that would have been incurred had the disease not been speedily diagnosed and properly treated.

Poultry farmers who suspect that their birds are affected with a notifiable disease should send a live, sick bird to the Veterinary Research Institute, Story-street, Parkville, N.2, where a diagnosis will be made free of charge. In addition a letter should be forwarded to the Director of the Institute notifying him of the despatch of the bird and setting out the history of the case.



Showing the cycle of infection in pullorum disease.

Further, unless adequate precautions are undertaken, succeeding hatches may contract the disease, even in the absence of infected eggs, through the contaminated incubators or brooders. The system of custom hatching may thus be responsible for the contamination of otherwise clean stock.

A considerable amount of investigation has been directed to the determination of the egg-laying capacities of "carrier" hens, including their fertility and hatchability. In general, it may be stated that 2 per cent. of eggs from an infected hen usually hatch into infected chicks. Other eggs may prove fertile, but do not hatch, and a large percentage are unfertile. Although this figure may appear small, yet the highly infectious nature of the disease, especially under modern conditions of poultry keeping, makes it quite a formidable one.

Distribution.—The disease is world-wide in its distribution and occasions severe losses in all poultry-raising districts. For convenience, the disease will be described in two sections—(1) in young chickens; and (2) in adult fowls.

Chickens.

With the development of artificial incubation of fowls' eggs, pullorum disease has become more important. Like other poultry diseases, it owes its formidable nature to the intensive system of poultry keeping. It does occur, however, with hen-hatched chicks, although not nearly to the same extent nor as seriously.

Mortality Rate.—This is estimated at between 40 per cent. and 90 per cent. The average is 75 per cent., although we have known small batches of chickens to be completely destroyed.

Symptoms.

In the absence of obvious faults in the system of incubation or general management, the appearance of a fatal disease within a few days, or even a week or two after hatching, should be viewed with grave suspicion. As a rule, the deaths from pullorum disease start gradually, but rapidly reach a peak four to seven days after hatching. The affected chickens usually appear dull and drowsy, separate themselves from their fellows, are ruffled with drooping wings, and show a general absence of the liveliness and chirpiness which characterize healthy chicks.

Death may ensue rapidly after symptoms are first noticed, or the affected chicks may show a general weakness, staggering walk, distended abdomen, absence of appetite, and in a number of cases, a soft frothy yellowish-white diarrhoea which may paste up the vent and so hinder the passage of subsequent motions. It was this symptom which originally gave rise to the name Bacillary White Diarrhoea. The fact that it is not always present, and that other conditions may be accompanied by a whitish diarrhoea has led to the adoption of the term, Pullorum disease.

Swelling of the feet with lameness may also be found. After the seventh day, the death rate gradually declines, and if any survivors are left, they may be reared apparently successfully, although some may remain stunted for a time.

Post-mortem Findings.—There has been some confusion regarding the post-mortem characteristics of pullorum disease. Formerly, it was assumed that the presence of a bright yellow liver, with a persistence of the yolk sac in a young chicken was indicative of pullorum disease. Research work has shown that even after nine days, yolk masses up to 4 grammes in weight may be found in healthy chickens, and the yellow colour of the liver is directly due to the presence and continued absorption of yolk from the yolk sac. The most that can be said regarding this phenomenon is that in pullorum disease, the absorption of the yolk material may tend to be delayed.

In a number of chicks dying from this disease it is impossible to find any lesions, and the presence of the disease is only substantiated by bacteriological methods. In about 60 per cent. of all affected chickens, however, definite lesions are discoverable in the lungs. These lesions consist of small yellowish or greyish cheesy foci in one or both lungs, which may be so numerous as to coalesce, so that little normal lung tissue remains.

Similarly, cheesy foci may be found in the heart muscle, gizzard, and in the wall of the large intestine and caeca. The liver is usually enlarged, and may show haemorrhagic or blood-stained patches. Occasionally, the lung lesions may take the form of a general pneumonia, without the localization of the infection in small abscesses.

Left, Normal ovary. Right, Ovary affected with pullorum disease. [After Rettger.

Differential Diagnosis.

In actual practice, it is necessary to differentiate pullorum disease from aspergillosis and coccidiosis. Aspergillosis was formerly thought to be a common disease of young chickens, characterized by nodules in the lung, and mouldy growths in the air sacs. We have seen only one or two cases of aspergillosis in this laboratory during the past fourteen years. Aspergillosis is in fact, a rare disease of chicks, and its diagnosis is readily made by bacteriological examination of lesions.

Coccidiosis, although usually a disease of older chicks, may occur in very young chickens. We have found, on a number of occasions, both coccidiosis and pullorum disease in chicks just over a week old. The differentiation between these two diseases is possible only by expert laboratory examination.

Showing chickens affected with pullorum disease or bacillary white diarrhoea. [U.S.D.A.

Adult Fowls.

It was formerly supposed that the chronic or "carrier" stage in the adult hen with ovarian infection was unaccompanied by serious effects. This is by no means the case, and outbreaks of disease, with a significant mortality in laying hens, have occurred as the result of pullorum disease infection. As a rule, the infection in an adult hen will show its serious effects at the height of the first laying period. There may be sudden, or apparently sudden, death without any premonitory symptoms being developed, and this is attributed to the effect of the disease on the heart.

Usually, there is a period of indefinite sickness, with a darkened comb, listlessness, and emaciation, terminating with diarrhoea. Where there is a chronic inflammation of the oviduct, the mucous membrane of the vent may be protruded and show congestion. Haemorrhage from the vent is not uncommon, frequently leading to cannibalism.

On post-mortem examination, the following lesions occur in the following order of frequency :—

1. Misshapen and discoloured yolks in the ovarian system. The diseased ova are hard, shrunken, and angular. The yolk has changed to a dark brown or greenish colour, and on section is tough in consistence. Occasionally, affected ova may be cystic, with dark fluid contents. Small sac-like structures, with semi-solid or solid contents, may be found free in the abdominal cavity.

2. Peritonitis, with an abnormal moistness of the mesentery, which often contains in its folds a yellowish

sticky mass, resulting from the rupture of a yolk sac. There may be a purulent peritoneal exudate. Occasionally, there is splenic enlargement, and the liver may be enlarged, softened, with a bronzed appearance, and showing pin-point spots in its substance.

3. The heart may show inflammatory tumour-like masses in the musculature, and not infrequently, there is an inflammation of the heart sac. The heart itself, is frequently enlarged. The intestine may show marked congestion or inflammation.

One of the most fruitful sources of outbreaks of pullorum disease in adult stock, is the reprehensible practice of feeding infertile eggs from an incubator, to fowls—many of these eggs may be infected with *Salmonella pullorum*, and the practice cannot be too strongly condemned.

Control Measures.

In a discussion of the control of pullorum disease, there are three main questions to which an answer should be forthcoming, if control measures are to be effective—

1. What can be done to prevent the entrance of a disease into a hitherto clean flock?

2. What steps should be taken to limit the spread once the disease has made its appearance?

3. How can the disease be eliminated from an infected flock?

To prevent the introduction of pullorum disease to a clean poultry farm, it is essential that only healthy chicks or fowls, or eggs from healthy hens be used for restocking and for breeding purposes.

The most valuable weapon available in the control of this disease, is the agglutination test. It has been quite adequately proved that, used in the proper manner, this test is as accurate as any biological test at present in use for the detection of disease.

The agglutination test is based on the fact that the blood serum of an infected fowl possesses the power of causing the clumping or agglutination of the germs (*Salmonella pullorum*) where a suspension of the germs in saline is mixed with the serum in certain proportions. This test has been applied to many thousands of blood samples at the Veterinary Research Institute, during the past few years, with the result that a number of poultry farmers have been able to eliminate infected hens from their breeding stock, and consequently, to reduce their chicken mortality to a minimum. It is no exaggeration to say that several poultry men would have been forced to relinquish their business but for the use of this test.

The blood samples for the test are taken by making an incision with a sharp clean knife or scalpel in the wing vein, at the point where it passes over the elbow joint. A small incision made in the direction of the length of the vein, rather than across it, is preferable. The blood is allowed to flow into small, clean, dry tubes, which may be obtained from the Institute. Immediately the samples are taken, they should be corked and forwarded at once to the laboratory by the most direct route. If practicable, it is advisable, when undertaking the collection of blood samples for the first time, to seek the assistance and advice of the Livestock Division of the Department of Agriculture, or the Veterinary Research Institute.

The agglutination test may be relied on to prevent the introduction of pullorum disease into a clean flock, and no birds should be introduced unless they have passed the agglutination test. If possible, birds should be isolated after introduction and retested after four weeks, before adding to the flock. Eggs for hatching, or day-old chicks, should only be bought from properties where the disease is not present.

In cases where it is not possible to obtain a guarantee of freedom from pullorum disease, isolate all eggs for hatching, or chicks, for four weeks after hatching, before liberating. Of course, if the disease makes its appearance in "brought-in" birds or eggs, then exceptional care must be taken in regard to isolation and disinfection of premises.

Should the presence of pullorum disease be suspected, it is essential that no time be lost in establishing a diagnosis. In the meantime, sick chicks should be isolated, including in-contacts, and dead birds cremated. Where only a few chicks survive, it is better to destroy them all, but when the number of in-contact survivors is great, it may prove an economic necessity to rear them to maturity. This will always prove a source of some worry, so the sanitary and hygienic arrangements should be as perfect as possible, with avoidance of overcrowding.

It has been shown that the disease may be transmitted from adult to adult by contact, so that all in-contacts and reactors to the test should be efficiently isolated. It has further been demonstrated that *Salmonella pullorum* may remain viable for 100 days in moist droppings, pointing to the necessity for every precaution against the transference of infective droppings from pen to pen.

It should be a firm rule that survivors or in-contacts of an outbreak of pullorum disease are not subsequently used for breeding purposes. If practicable, they may be reared in isolation for table purposes. If, for some special reason it is desired to breed from a survivor or in-contact, two negative blood tests at intervals of three months, should be obtained. A reactor should never be used for breeding.

Elimination of the disease from an infected stock is practicable by the regular application of the agglutination test, combined with suitable hygienic measures. First, all reacting birds should be isolated and used for table purposes; secondly, negative reactors should be placed in thoroughly disinfected separate sheds, and on clean ground. If the ground has been liable to contamination, it should be dressed with ground quicklime and poultry kept off for at least a month. Preferably, and if practicable, the top layer of the soil should be removed to a depth of six inches, mixed with lime, and buried, using the fresh soil from the hole to replace it. Sow with grass and keep birds off until a good growth is established. Thirdly, regular testing of the negative flock, and removal of reactors as they may appear; with a heavy initial infection retest in three months, otherwise every six months should be sufficient.

Fourthly, every care should be taken to disinfect incubators and brooder houses. With regard to the latter, especially if an impervious floor exists, the use of a painter's blowlamp will prove the most efficient germicide. The interior of the incubator should be thoroughly cleansed and disinfected, using either sodium hypochlorite, or formalin, or formaldehyde gas.

The best time for the application of the agglutination test to adult stock is two months after laying commences. Male birds should be tested with the hens.

Fumigation of Incubators.—Twenty cubic centimetres of formalin per 100 cubic feet of incubator space, evaporated from cheese cloth, has been found effective in destroying *Salmonella pullorum* on egg shells, cotton squares, and newly hatched chickens.

It is very desirable that poultry keepers should realize the economic significance of pullorum disease. Quite apart from the losses due to the mortality of chickens, it has been demonstrated that healthy fowls lay more eggs than reactors. For example, at the conclusion of an egg-laying competition in England, the fowls were blood tested for pullorum and then grouped according to their reactions to the test.

Average number of eggs laid per bird during test.

Non-reactors	204·8
Reactors	141·8

Such results indicate the value of blood testing and elimination of reactors, even on farms where fowls are kept for egg production and not for breeding.

The control of pullorum disease, as with every contagious disease, can be assured only by the definite co-operation between those engaged in the industry and the Department of Agriculture, which administers the Stock Diseases Act.

An important step, and one which would have a marked effect, would be the certification of the flocks proved free from pullorum disease. The Department has in view a scheme that would give breeders the opportunity of having their breeding stock tested under official auspices, and those flocks proved free from the disease "accredited". Of course, certain fundamental principles would need to be observed with regard to the introduction of fresh stock to an accredited flock. In this way, purchasers of eggs for hatching, or of day-old chickens, by dealing with accredited farms, would be safeguarded, as the possession of a Government certificate, by a poultry farmer, would imply a freedom of his stock from pullorum disease.

Summary.

1. Pullorum disease is a contagious disease of poultry, caused by a micro-organism or germ, the *Salmonella pullorum.*

2. The disease is usually accompanied by a high mortality. Recovered female chickens frequently retain the infection in their ovaries, and become "carriers."

3. The acute form among young chickens generally starts in the incubator through the hatching of infected eggs laid by a "carrier" hen.

4. Deaths occurring among newly-hatched chickens, with an increase in the rate of mortality from the fourth to the tenth day, should arouse the suspicion of the owner. In such cases, a definite diagnosis should be sought. For this purpose, preferably live chickens should be submitted to a laboratory for examination.

5. When a diagnosis of pullorum disease has been confirmed, all sick chickens should be destroyed, and all carcasses burnt.

6. Chickens in contact with diseased birds should be isolated immediately.

7. Chicken houses, incubators, brooders, &c., in which the disease has occurred, should be thoroughly and efficiently disinfected before being used again.

[*Continued on page* 330.

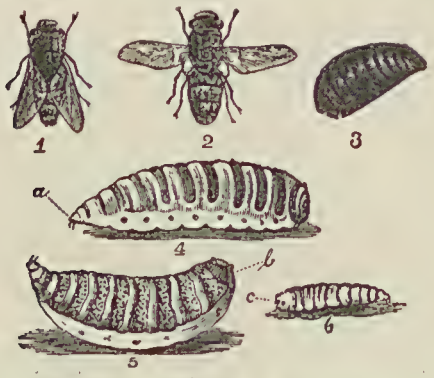
The Sheep Nasal Bot

Compiled by the Veterinary Staff.

THE sheep nasal bot is the larval or grub stage of the sheep bot-fly (*Oestrus ovis*), which is a yellowish grey hairy fly somewhat smaller than the common blowfly. It is rare for one of these to be seen when active, since it is an exceedingly fast and noiseless flier.

In the heat of the day during the summer and autumn months, the fertilized female fly deposits small larvae or grubs one-twelfth of an inch long on and around the nostrils of sheep. In the presence of the fly the sheep become uneasy and attempt to protect themselves by milling round and pushing their heads against other sheep or into herbage or loose ground. During an actual attack a sheep will rub its nose along the ground and endeavour to keep the fly from striking by shaking its head and brushing at its nose with its fore feet.

Once the grubs are deposited at the nostrils, they make their way, aided by two small hooks, up the nose until they ultimately become located in the upper nasal passages and the air cavities of the face, where they attach themselves to the lining membrane. In these positions they grow until fully developed, when they are about four-fifths of an inch long and one-third of an inch in width (that is, slightly larger than the horse bot). The young larvae are white and, as they develop, they become yellow or brown, the eleven segments showing up distinctly. The head end has two hooked appendages and the tail end two breathing pores.



1 and 2. Adult Fly (nat. size); 3, Pupa; 4. Full-grown Larva, dorsal view (enlarged); 5. Same, vertical view; 6. Young Larva.

In the spring time, after a period of about ten months, the grubs leave the air cavities and pass into the nose from which they are expelled by sneezing; they then burrow into the soil, where a change in development, known as the pupal stage, takes place. Further development results in the formation of the adult fly, which emerges in from one to two months' time; fertilization of the female takes place and the life cycle proceeds once more.

Sometimes the grubs reach parts of the head from which they are unable to escape when fully grown, and when this happens they die, and are then seen occasionally when a sheep's head is split open.

Symptoms.

The presence of these parasites in the nasal passages and in air spaces of the head sets up an irritation of the lining membrane, causing a nasal discharge with consequent snuffling and sneezing; such condition is often referred to as "snotty nose."

A percentage of sheep infested will become affected in general health. The irritation set up, with its consequent sneezing, does not allow the sheep to thrive. It is also possible that, by the puncturing of the membrane by two small hooks of the young bots as they progress along the nasal passages, disease producing microbes may gain access to the system.

Prevention.

Actual treatment of affected sheep is rarely necessary, but there are certain preventive measures that are practised. Shelter trees and plantations should be provided in all paddocks. The ploughing of furrows across the paddocks when the flies are active, provides a small bank of soft earth into which the sheep may push their noses.

Finally, smearing the noses with a preparation, such as Stockholm tar or Boro-glycerin, is recommended for small valuable flocks. It is advisable to apply the preparation by hand the first time, then to use a covered lick trough in the top of which are several 2-in. holes. The preparation is placed around the edges of the holes, and when sheep use the trough, the material is smeared around their noses.

Johne's Disease

By R. J. de C. Talbot, Chief Veterinary Officer.

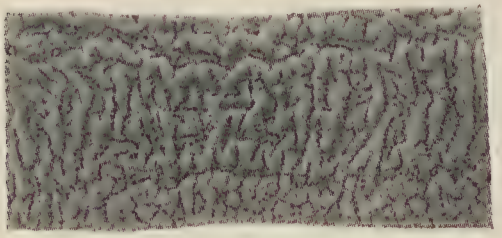
JOHNE'S (pronounced *Yoanies*) Disease was first detected in Victoria in 1925. It was so named because in 1895 the causal organism was described by Professor Johne of Dresden. It is an infectious and incurable disease affecting cattle and sometimes sheep, and is characterized by a chronic inflammatory condition of the intestines, with consequent interference with the digestive processes resulting in an intermittent diarrhoea accompanied by emaciation.

An advanced case of Johne's Disease.

[Min. of Ag. and Fish.

The history of the disease is of interest in that from a perusal of early records it becomes apparent that prior to Johne's work in 1895 it was thought to be a manifestation of tuberculosis of the bowel. The two diseases, however, are quite distinct.

Lately Johne's disease is receiving more attention in various countries as its serious effects on the live stock industry are being more clearly realized. The insidious nature of the disease, with its rather indefinite symptoms in the early stages, its long incubation period and, until recently, the absence of reliable methods of diagnosis, have militated against the adoption of control measures in countries where the disease has become firmly established. Even at the present time some authorities consider that it is an almost hopeless task to completely eradicate Johne's disease from certain countries in Europe, owing to its widespread distribution. One American authority has stated that the problem of the control of Johne's disease in the United States of America is to-day comparable to the problem presented by tuberculosis 25 years ago, and unless it is attacked with the same vigor and efficiency it will in time prove a very serious menace to the cattle industry in that country.



Internal surface of intestine showing wrinkled mucous membrane.

Min. of Ag. and Fish.

As far at can be estimated, the position in Australia generally regarding Johne's disease does not appear to be very serious at the present time.

Victoria is the only State in the Commonwealth where the disease has become established to any extent, and in about seventeen years it has extended to only fifteen properties in this State.

On the other hand, unless effective steps are taken to control its spread, it is possible that in time this disease may cause serious economic wastage to the dairying industry. It is therefore very desirable that every effort be made in this State, not only to control the spread of the disease, but also to eradicate it completely.

Symptoms.

There are no characteristic symptoms in early cases, but as the disease progresses there is a temporary loss of appetite, with general unthrifty

Another typical case of Johne's Disease.

appearance. These symptoms are followed by severe diarrhoea, accompanied by loss of condition. The diarrhoea is at first intermittent, recurring at more or less regular intervals, and between attacks the general condition of the beast may show some improvement. In the last stages diarrhoea is constant; great thirst is exhibited, and soft swellings appear under the jaw and brisket; the animal finally becomes greatly emaciated and dies from exhaustion, due to superpurgation.

It is characteristic of the disease that an affected pregnant animal may show little clinical evidence of the trouble until she calves, when a rapid loss of condition occurs and death follows quickly.

Johne's disease may be slow in developing after an animal has been exposed to infection; in fact, it is known that this period of incubation may be as long as three or four years. This fact makes the complaint an extremely difficult one to control. Fortunately, however, a diagnostic test, similar to the tuberculin test, known as the Johnin test has been evolved, which makes it possible to ascertain the presence of the disease in animals actually before they are exhibiting any of the severe symptoms.

No satisfactory treatment is known but suspected animals should be immediately isolated until such time as a positive diagnosis can be made. Millions of the bacteria which cause the disease are contained in the faeces of affected animals, and therefore, the droppings from suspected or diseased animals should be buried deeply with lime.

Johne's Disease is schedule under the Stock Disease and Cattle Compensation Acts, and owners must immediately report all suspected cases to the Chief Inspector of Stock, Department of Agriculture, Melbourne, C.2.

Pullorum Disease

(*continued from page* 327).

8. In flocks where the disease has occurred, the breeding stock should be tested, and the reactors to the test eliminated before next breeding season. Eggs from non-reacting hens only, should be used for hatching. All reactors should be isolated, and used for table purposes.

9. The disease is very contagious. The germs causing the disease are present in large numbers on the bodies of diseased chickens, in the droppings, and in the litter of incubators, brooder-houses, &c. Extreme care should therefore be taken to thoroughly wash and disinfect the hands, boots, overalls, &c., after handling infected material.

At the Veterinary Research Institute, it has been found possible to examine a limited number of blood samples each year for the presence of pullorum disease. A nominal charge is made, and the collecting tubes will be supplied by the laboratory on application. Poultry keepers who desire to have birds tested should communicate with the Director, Veterinary Research Institute, Story-street, Parkville, N.2.

Transport of Pigs

Need for Careful Handling

THE Director of Agriculture has received from the Victorian Pig Industry Committee a letter pointing out that for some time past that Committee has given serious consideration to the extent of the damage which is noticeable in carcasses inspected after slaughter, due to rough handling which pigs frequently receive during transit from farm to market.

The Committee points out that advices from practically all establishments treating pigs, both for local and export purposes, show that carcasses bearing freshly inflicted wounds and marks, such as would be caused by the use of whips and sticks in the driving and loading of the animals, are constantly coming under notice. Needless to say, these injuries reduce the value of the side or cut, and are disfiguring to the general appearance of the carcass as a whole.

At a meeting of the Committee held at the Department of Commerce offices on 13th May, 1937, after consideration of methods by which the losses caused in this manner might be minimized, the following resolution was passed:—

> "That representations be made to the Department of Agriculture, the Commissioner for Railways, the Live Stock Agents' Association, and the Victorian Dairymen's Association, seeking their co-operation in bringing before the producers and others concerned, the advantages of minimizing as far as practicable the losses due to rough handling of pigs during transit to market."

It is not uncommon and very annoying, after the carcass has been cleaned, to see a large bruised spot showing on the ham, the most valuable part of the pig. This spot is the result of a kick by the man loading. In addition, the skin may be torn in places, red and inflamed as a result of bites from dogs which some drovers persist in using. The provision of suitable ramps where the pigs are loaded at the farm is urged.

Perhaps most damage is done by the loading of stags in trucks with other pigs. Sometimes 50 per cent. of the carcasses may be damaged through savage attacks from the stag, and when a carcass is dressed and hung, red inflamed gashes necessitate the cutting away of much valuable flesh. In some cases this so detracts from the appearance of the side that it has to be made up into small goods.

Injured carcasses, in most cases, are due to ignorance and carelessness, although too often the cause is sheer brutality. Pigs should be handled quietly on all occasions, as they respond much better to this type of treatment than to blows and kicks; besides, the latter not only cause suffering to the animal, but also reduce the profit of the bacon curer.

Avian Tuberculosis

(Tuberculosis of Birds)

Compiled by the Veterinary Staff

AVIAN tuberculosis may be considered as a disease with a dual significance, as it is responsible not only for losses among infected poultry, but also its causal organism may infect mammals. The disease in birds is closely comparable with mammalian tuberculosis, and is characterized by a wasting sickness, with the production of lesions characterized by tubercle formation.

Avian tuberculosis is widespread, and has been reported from all countries where the poultry industry forms a part of the agricultural activities. It was probably first recognized by Koch in 1882, and since then many workers have studied the disease, especially with reference to the characteristics of the causal organism. Avian tuberculosis is not uncommon in Victoria, and occasionally it is responsible for numerous deaths in an infected flock, although usually there is a history of odd deaths at infrequent and fairly long intervals. Although statistics on the incidence of avian tuberculosis in Victoria are not available, it would appear that the disease is not as common here as in the old world.

Cause.

The avian tubercle bacillus is closely related to the mammalian forms, but it can be readily differentiated from the human and bovine organisms by the comparative ease with which it may be cultivated artificially, by its more rapid growth, its more uniform staining reactions, and the reaction of small laboratory animals to inoculation with it.

Susceptibility.

Most of the domestic poultry have been found susceptible to natural infection, and the disease has been observed in fowls, turkeys, pheasants, ducks, geese, swans, canaries, parrots, and pigeons. Moreover, it is stated to be common in wild birds kept in captivity. It is interesting to note here that parrots are frequently infected with the human type of bacillus and appear more susceptible to this type than to the avian strain. Canaries have also been found infected with the human tubercle bacillus. Ducks and geese are rarely found infected naturally. In Victoria, apart from fowls, the disease has been recognized to date in turkeys and a swan.

Age Incidence.

Generally speaking, avian tuberculosis is a disease of adult fowls. It is seldom seen in birds under six months of age, while infected fowls under twelve months of age have rarely developed the disease to the extent of becoming spreaders of the infection. This general observation has been used in America to confirm one of the recommendations for the reduction and elimination of tuberculosis from infected flocks.

Symptoms.

The main sign which should lead to a suspicion that a bird is infected with avian tuberculosis is a progressive emaciation and anaemia. Lameness is frequently the first symptom noted. Often one finds the breast muscles completely atrophied with a corresponding prominence of the sternum, which is very evident on handling the birds. The skin, mucosa, comb, and wattles become pale through the anaemia. As the disease progresses, affected birds become disinclined to move about either through extreme weakness or the development of arthritis in one or more joints. Tuberculous arthritis is one of the commoner findings in an infected flock. The appetite may remain good, although towards the end it becomes capricious and finally greatly impaired.

Post-mortem Appearances.

In the majority of cases, the spleen and liver are found to be involved, the latter organ with slightly greater frequency. The lesions consist of roundish yellow nodules, varying in size from a pin's head to the diameter of a threepenny piece. In well-developed lesions,

caseation is found, the cheesy material being readily shelled out. Very early small lesions are whitish or pearly in appearance, and of a crystalline consistence. Calcification is a rare finding in avian tuberculosis.

Frequently the lesions in the liver and spleen vary considerably in size—and, when numerous, the affected organ is increased greatly in its dimensions. Next to the liver and spleen, lesions of the intestine and peritoneum are found with fair regularity. The intestinal lesions consist of small tubercles

Fowl showing Tuberculosis of the Liver.
The small white spots on the liver are the lesions caused by the disease.

on the submucous layer which enlarge and protrude from the serous surface, and frequently open into the intestines—sometimes they become pedunculated. There may also be isolated ulceration of the intestinal mucous membrane.

The lungs are occasionally involved, and kidney and ovarian lesions may be found. It may be stated as a general rule, however, that tuberculosis in the fowl is primarily an alimentary disease, and that early cases will show lesions in the liver and spleen. With the extension of infection other organs and tissues may become involved.

The long bones may become the seat of tuberculous lesions and, in very rare cases, skin involvement, with tuberculous masses around the roots of feathers, may be found. Skin lesions are more commonly seen in parrots and pigeons.

Prevention.

Medicinal treatment is of no value; therefore preventive measures must be adopted. Because of the insidious nature of the disease, and difficulties in diagnosis, isolation of all affected animals is not possible; therefore, the most practical and economical method of procedure is to slaughter the whole flock as soon as the disease is recognized. Animals in good flesh may be used for food if, on examination, the liver or spleen shows no white or yellow spots (these usually are from the size of a pin-point to that of a pea or larger), and provided there are no nodules or lumps on the intestines. When lesions are present the flesh cannot be considered suitable for food.

The poultry yard as well as the houses and coops should be thoroughly cleaned and disinfected before fresh stock is acquired. Disinfection is necessary because of the fact that the bacilli are found in the droppings in great numbers. For this reason every effort should be made to destroy the droppings.

Disinfection of Fowlhouses.

1. Remove all litter from floors, nesting places, and yards, and, to avoid contamination of the surrounding soil, burn the rubbish as near the building as possible.

2. The contents of all hoppers, feed-bins, and troughs, such as dry mash or other food or grit, should be burnt with the litter. Scald all utensils, pans, &c., using steam, if possible.

3. Remove all nests, movable roosts, windows, and portable fixtures from buildings; thoroughly wash with warm water and soap to which disinfectant has been added, and place in the sunlight.

4. Thoroughly sweep down the inside of buildings so as to remove all dirt, cobwebs, &c., or, if possible, flush them out with a hose. All accumulations of hard droppings should be softened with water and scraped off with a sharp instrument.

Disinfection may now be commenced. Thoroughly spray all buildings, fences, yards, and appliances with a 5 per cent. solution of

lysol. Sunlight is the best of all disinfectants, and its free access to all buildings, &c., should be allowed where possible.

Slake some fresh quicklime by adding boiling water (when heat ceases the lime is slaked). Thin to the consistency of milk with boiling water, to which has been added 1 oz. of powdered glue previously dissolved in hot water, and 4 oz. of lysol for each gallon of completed wash, and strain through two thicknesses of cheese-cloth. The easiest method of applying lime wash is by means of a spray pump, which can be purchased at a reasonable cost, and can be used for other purposes. In the absence of a spray pump, a whitewash brush may be used, although it is difficult to fill the cracks and crevices without a stream to drive in the solution. These cracks serve as breeding places for ticks, lice, &c., and should be given careful attention. Where an infectious disease such as tuberculosis is present, it is wise to spray the interior at least twice, with an interval of one week between each application. The runs should be covered with quicklime and the surface ploughed up or dug. They should be divided and changed each year, one-half being used for rape or other green crop. If portable houses are in use, they should be moved frequently, as feeding fowls on the same ground year after year serves to infect them with numerous diseases. Disinfect in the spring and autumn each year, if possible, and by all means before introducing fresh stock.

Butter Production and Export

The following table shows:—

(*a*) Factory production of butter and cheese in Victoria for the period July, 1936, to April, 1937, compared with the corresponding period of 1935-36; and

(*b*) Quantities and percentages of various grades of bulk butter examined for export in Victoria from 1st July, 1936, to 29th May, 1937, in comparison with the corresponding period of 1935-36.

FACTORY PRODUCTION OF BUTTER AND CHEESE IN VICTORIA (QUANTITIES IN TONS).

Month.	Butter.		Cheese.	
	1936-37.	1935-36.	1936-37.	1935-36.
July to December	39,337	41,484	3,418	3,105
January	7,866*	6,670	632	483
February	5,867*	4,613	466	334
March	5,065†	3,589	423	263
April	3,743†	2,853	333†	226
Totals, 10 months	61,878	59,209	5,272	4,411

* Revised. † Subject to revision.

BULK BUTTER EXAMINED FOR EXPORT IN VICTORIA (QUANTITIES IN TONS).

Period.	1936-37. How Graded—				Total.	Period—	1935-36. How Graded—				Total.
	Ch.	1st.	2nd.	Pty.			Ch.	1st.	2nd.	Pty.	
1st July to 1st May	26,975	9,092	2,594	430	39,091	1st July to 2nd May	22,268	11,623	2,795	419	37,105
2nd to 29th May	289	75	68	8	440	3rd to 30th May	36	29	37	11	113
Totals 1st July to 29th May	27,264	9,167	2,662	438	39,531	Totals 1st July to 30th May	22,304	11,652	2,832	430	37,218
Percentages	69·0	23·2	6·7	1·1	..	Percentages	60·0	31·3	7·6	1·1	..

Bacterial Spoilage

A Sweet Wine Disease

By D. G. Quinn, Viticulturist

THIS bacterial spoilage is also variously spoken of as Lactic, Mannitic, Tourne, Scud, and Cottony Mould disease. The term Australian Sweet Wine Disease is often used in this country, but is most unsuitable and misleading. Whether only one or several organisms cause a similar trouble may not yet be known, but spoilage due to bacteria in fortified wines is reported in California, South Africa, and Portugal.

In an advanced state the disease is easily recognized by a murky condition, a hot sharp acid flavour, the evolution of gas when working actively, or by an albuminous deposit during cold weather when the organism may lie dormant. Loss of sugar and a rise in the fixed and volatile acidity are the chief chemical changes.

The object of this article is to summarize our present knowledge of bacterial spoilage in sweet wine and methods by which this trouble may be avoided or corrected.

While grapes of the proper variety, correct ripeness and in sound condition are essential to the making of good wine; nevertheless it is true that poor or even spoiled wine may be made from the best grapes if certain well established principles and practices of wine-making are ignored. It must be pointed out that the biologist and chemist can assist the winemaker. Diseased wines can be detected by the centrifuge and microscope before any other method and consequently before much damage occurs. A microscopic examination also allows one to say whether cloudiness is due to disease germs, yeast, or a chemical fault such as casse or unstable colloids, and so gives a rational guide as to what treatment is necessary.

It should be stressed that manufacturers of other foodstuffs and beverages realize that irreparable damage is done to the popularity and sales of their commodities if one batch of produce "goes wrong" after it has left their hands. They take special precautions to avoid this, and vignerons should realize that every imperfect wine which touches the market probably is responsible for the loss of customers for life. Compared with other countries the Australian average wealth per head is high, the consumption of wine is low, and perhaps, from the business point of view, we should cease to dismiss these facts with the old though not too comforting excuse that Australians are not wine drinkers.

Not a New Disease.

Many people are apt to look upon this trouble as due to a relatively new disease, but it would be more accurate to say it is a new trouble from an old disease; for, upon reflection, one must come to the conclusion that the causal organism has been with us since those days referred to in the Book of Genesis. The ancients knew of wine sickness, and they also knew of our main remedial treatment, viz., sulphur dioxide; but they had no idea of the cause of the various sicknesses to which wine is liable until the famous French biologist, Louis Pasteur, some 70 years ago astounded the world by stating that the cause was due to living organisms invisible to the naked eye. He named and studied the characteristics of many of these organisms, and laid down certain fundamental principles for combating disease in wine. The remedies he recommended may have been raised to a higher stage of perfection in the interval, but they have not been altered appreciably.

In a paper submitted to the General Assembly of the French Society of Agriculture in March, 1937, and published in "Progress Agricole et Viticole," 4th April, 1937, E. Hughues, Directeur, Station Oenologique de l'Herault states that diseased wines which, according to Pasteur, were very numerous in 1866, are less frequently encountered to-day; nevertheless, we still see too many defective wines, and the majority of these are due to bacteriological troubles.

Pasteur pointed out that aerobic organisms such as the Acetic and Mycoderma vini groups

could not develop if the wine was kept out of direct contact with the air. To combat that group of organisms which can develop without the aid of the free oxygen of the air, he recommended temperature control, pure yeast cultures, antiseptics such as fumes of sulphur and alcohol, or pasteurization.

Apart from the fact that Pasteur and his continental successors concentrated upon natural wines, the technique of sweet wine manufacture has changed somewhat during the past twenty years. Prior to this change, fortification with alcohol was considered sufficient to protect the wine from any bacterial action. Now, however, we are aware that certain sugar consuming bacteria (*genus Lactobacillus*) will develop in certain fortified wines and give rise to undesirable flavours. Again, it is pleasing to know that these same bacteria can be introduced, but will not develop in all sweet wines. Several white dry wines, said to be suffering from casse, have been submitted this season by different growers, but actually these have also been heavily infested by rod bacteria resembling the type found in sweet wines, and the trouble has been cleared up, as will be described shortly, by the same treatment as indicated for sweet wines.

Very little was heard about this disease in fortified wines until the demand set in for light tawny coloured early maturing sweet wines. To produce this type of wine it is necessary to draw the wine off the skins early in the fermentation period, and this evidently lowers the amount of tannin and other natural preservative substances extracted from the skins. These substances should be present to precipitate the albuminous material and so bring about early clarification; hence nowadays the artificial addition of much larger quantities of tannin is necessary. However, although we know wines vary greatly as regards their susceptibility, we cannot pin this matter down to the presence or absence of any one chemical constituent at present, the trouble sometimes becoming acute even in the fermenting tank.

The disease sometimes, apparently, works very slowly; sometimes very rapidly; sometimes it ruins the wine; sometimes it only lowers the quality slightly. Another theory put forward is that just as in common practice we acclimatize yeast to work in the presence of various antiseptics, so the causal organism of this sweet wine problem may be a strain of an organism which has become acclimatized to stand high percentages of alcohol owing to the practice of lightly fortifying wines at vintage time and "topping up" later. The presence of this acclimatized strain may also account for the great trouble experienced in some cellars and not in others.

The following analysis indicates the chemical change which occurred in a wine containing 34 per cent. proof spirit and affected with this disease between 23rd March, 1937, and 27th April, 1937:—

	Analysed 23.3.37.	27.4.37.
Baumé (degrees)	3.0	2.8
		Grms. per 100 c.c
Fixed acidity	0.340	0.372
Volatile acidity	0.053	0.094
Reducing sugars	5.12	3.41
Glycerine	0.20	0.29
pH value	3.9	3.9

The amount of gas evolved over this period of 35 days was almost equal in volume to the sample of wine under test, viz., 500 ccs. wine evolved 457 ccs. of carbon dioxide gas. This indicates that the crackling or silent fermentation sometimes heard in maturing vessels need not necessarily be due to a relatively harmless secondary yeast fermentation.

Methods of Prevention.

Our present recommendations for preventing the development of this sweet wine disease may be summed up as follows:—

(1) Beware of mouldy or mildew damaged grapes.

(2) Force the fermentation through rapidly by using 3 per cent. of an activated pure yeast culture (agglomerating type) which has been acclimatized to sulphur dioxide. This is necessary, as a natural fermentation consists of many races of yeast and bacteria in a comparatively sluggish state.

(3) Add up to 3½ oz. of sulphur dioxide (SO_2) or 7 oz. of potassium metabisulphite per ton to crushed grapes. (Fifty parts per million of SO_2, equal to 3 oz. of bisulphite, per ton will prevent growth of lactic bacteria under laboratory conditions, but double this quantity is advisable owing to the difficulty of obtaining an even distribution in a large tank.)

(4) Hasten clarification by the liberal use of tannin. If the wines are drawn off the skins early, 5 to 8 oz. per ton may be used.

(5) It is a fairly common practice among wine-makers to raise the acidity of sweet wine to the limit of the public taste, viz., 4.5 to 5 grms. per litre, expressed as tartaric acid. A low acidity (high pH) is thought to favour the development of a high volatile acidity, but this matter is somewhat indefinite. W. V. Creuss shows that, in a series of Muscat and Tokay wines graduated down from 10 to 5 grms. per litre expressed as tartaric acid, unsoundness quickly developed in wines containing less than 9 grms. Conversely the volatile acidity of other varieties (Sultana) did not vary appreciably through an acidity range of 3 to 8 grms.

(6) Light doses of sulphur dioxide at racking time.

Correction in Storage.

In the event of a wine contracting the disease in storage the suggested curative treatments are:—

(1) Addition of sulphur dioxide, fining, and racking. If no sulphur was introduced at vintage time 1¼ oz. of liquid sulphur dioxide or twice this quantity of bisulphite per 100 gallons will be required to still the activity of the disease, and allow the wine to settle bright. If the wine was treated with sulphur dioxide during fermentation only perhaps one-sixth to one-third of this quantity will be required to bring the strength of the antiseptic back to the necessary concentration, viz., 50 parts per million.

(2) The wine may then be fined, and the finings will "take." frequent filtration if a germ-proof filter is unavailable.

(3) Pasteurization at 70° Centigrade whenever a cloud is noted to develop.

Sterilization of Equipment.

As there is no way of telling whether other wines are or are not susceptible to this disease, the trouble must be considered contagious, and therefore all casks, floors, hoses, pumps, filters, and pipettes should be effectively sterilized after a diseased wine has been dealt with.

The casks should either be steamed for half an hour or washed on three consecutive days with a sterilizing wash consisting of—

1 oz. of bisulphite per gallon,

½ oz. of citric acid per gallon,

or filled with water, containing 2 lb. of sodium hypochlorite per 100 gallons, for a few days. The sulphite wash is also suitable for the other apparatus and a bucket of same should always be on hand for sterilizing the pipette and dip-stick. The dairy disinfectant "chlorize" is useful for floor sterilization, and may be used for other purposes, provided the persistent chlorine flavour is afterwards removed by rinsing with a dilute bisulphite wash. Similar after-care is necessary when sodium hypochlorite is used.

Department will Assist Diagnosis.

It must be appreciated that this is an age of specialization. The output of an average Victorian cellar may not immediately justify the cost of first class biological equipment; the effective use of this equipment is not a layman's job; and, finally, only a small percentage of the wines may require attention. For this reason the Department of Agriculture is prepared to examine and report upon any wines which may be regarded as suspicious by a vigneron. In fact, any such growers should communicate with Viticultural Station, Rutherglen, or the Department of Agriculture, Melbourne, when they will be advised of the procedure to be adopted.

The examination will consist of a microscopic investigation which serves to define the presence of the disease and, if necessary, a chemical examination of the volatile acidity which is the method of measuring the damage done.

Stock Foods Act

Foods and Licks Registered for 1937

By W. R. Jewell, M.Sc., Agricultural Research Chemist.

WHEN any article is sold, two people are naturally particularly interested, the buyer on the one hand and the seller on the other. Hence, anything that affects the sale of an article is of direct interest to both buyer and seller. Almost every farmer is, at one time or another, a purchaser of stock food, and is therefore interested in a new Act which was passed last session, and which concerns the buying and selling of certain stock foods. The manufacturer and importer are perhaps more definitely interested in this Act as they must comply with its provision relating to registration, labelling, &c. But the farmer also should be conversant with this legislation which is designed primarily to protect him in the purchase of stock food and, indirectly, to educate him in the choice of food for any particular feeding purpose. If he knows, even in a general way, the requirements of the Act, he is, apart from anything else, in a position to know whether stock foods supplied to him meet those requirements and, if not, he is able to inquire why or to refuse delivery.

This new *Stock Foods Act* 1936, which came into operation on the 1st of March, amends the principal Stock Foods Act and deals only with a certain class of stock food, omitting such things as hay, chaff, and grain which are adequately covered by the principal Act. The new Act is concerned mainly with the following type of food:—(*a*) Mixed, concentrated and prepared stock foods, which are all kinds of meals and foods prepared, whether in whole or in part from one or more kinds of grains, oils or juices, and which include all mixed prepared foods, and such things as meat meal, dried milk products, &c.; (*b*) condimental, patented, and proprietary stock foods which possess nutritive properties as opposed to purely medicinal preparations, which do not come under the Act; (*c*) all by-products such as bran, pollard, linseed meal, maize meal, oat branning, &c.; and last but by no means least, (*d*) stock licks of all kinds.

In the first place, every manufacturer or importer of any of the foregoing stock foods or stock licks must register annually his product with the Department of Agriculture, and on the application for registration must state the ingredients from which the product is made, and the chemical analysis. In the case of a stock food, the analysis must show the minimum amount of crude protein and of crude fat and the maximum amount of crude fibre contained in the stock food. In the case of a stock lick, the analysis must show the maximum percentage of salt and the minimum percentages of phosphoric acid, lime, and other mineral ingredients. All applications for registration must be approved by the Director of Agriculture who may refuse registration if he thinks fit. The Act makes it an offence to sell unregistered stock food or stock lick.

Every package of stock food or stock lick must bear a label which sets out the name and address of the manufacturer or importer, the distinguishing name of the material, the weight and the chemical analysis as just stated. It is very important that every farmer who buys a stock lick or stock food of the type outlined above should make sure that it carries this label when delivered to him. This is important for three reasons. In the first place, the label shows the farmer that he has received what he actually ordered; in the second place, it gives him the chemical analysis of the material, which should be of assistance in compiling rations for his stock; and in the third place the label is now a warranty to the purchaser of the accuracy of the particulars contained on it, and is now as much a warranty as was the invoice certificate.

There is only one exception to these labelling provisions, and that is in the case of bran and pollard, which now must bear a label on each bag, but on that label no chemical analysis will be shown. The analysis is omitted because the Act lays down a standard composition to which all bran and pollard must conform, so that the necessity for an analysis on the label does not exist. Further, if a purchaser goes into a shop and buys a brown-paper parcel of stock food which is supplied to him from a larger parcel which is labelled as is required by the Act, the shopkeeper is not obliged to attach a label to the brown-paper parcel. Obviously to require

every small lot of this nature to be labelled by the person selling it would be inflicting too much of a hardship on him.

Applications for registration are due before the last day of February each year, and when these are completed the Chemist for Agriculture must compile a list of all registered stock foods and stock licks setting out the name of the food and its analysis. This list for 1937 is given at the end of this article, and shows the various foods and licks roughly grouped into general classes. This list should be of considerable value to all farmers, as from it he can compare the relative merits of the different stock foods that are on the market and from the chemical analysis and the price, decide which is the cheapest to buy. For instance, from the list of meat meals that are registered he may, by comparing the percentage of protein and the price charged, determine which is the most economical to buy as a protein supplement.

The Act makes it an offence to sell any stock food which is not in accordance with the analysis set out on the label or which does not consist solely of the materials stated on the application for registration. Departmental officers will make periodical inspections of stock foods and stock licks and take samples, which will be analysed and the analysis compared with that guaranteed. In this way the purchaser will be assured of uniformity of supplies, and that the material he is buying is kept up to guaranteed standard. There are a number of minor amendments to the principal Act which need not be mentioned here except to say that provision is made for fixing the composition and fair average quality of any stock food, should at any time such action be considered necessary.

It might be asked why such legislation is necessary in the interest of primary producers. The sale of mixed, concentrated and prepared stock foods and by-products is rapidly increasing. Many mixtures are now on the market, and up to the present the purchaser has had little idea of their composition or of their nutritive value. He has thus been unable to determine whether they were suitable for a particular class of stock, and he has not had the information on which to calculate the proportions that should be used in compiling a balanced ration. Further, he had no actual guarantee that stock foods were wholesome and nutritious or that future supplies would be similar in composition to past ones. The Act not only ensures uniformity of supplies of any particular brand of stock food, but enables the purchaser to know what he is buying. Just as the labelling of fertilizers with their guaranteed analyses has educated the farmer in the use of fertilizers so, too, will the labelling of stock foods bring him in time to think in terms of nutritive ingredients, to the ultimate good of his stock and the benefit of his pocket.

The second reason why this Act was necessary lies in the fact that stock licks are coming more and more into prominence, because the question of mineral deficiencies has for some time been receiving consideration both by stock breeders and by scientific investigators. Because it is now realized that the mineral portion of a ration is of great importance and because mineral deficiencies have been shown to have a close relation to the health and productivity of stock, stock licks are now widely used, and the market has been flooded with numerous mixtures, some of which were based on claims that at present lack scientific foundation. While mineral licks are admittedly of extreme importance some manufacturers have, either wittingly or otherwise, exploited the purchaser either as regards the value of the mixture supplied or the price charged for it. Cases are known where exorbitant prices were charged for licks for which extraordinary claims were made. Farmers have suffered not only in their pocket, but also in the health of their stock by the injudicious purchase of mineral licks. This state of affairs can be completely remedied by this new Act whereby the actual analysis of the lick is shown on the label, thus enabling the farmer to know what he is buying, to choose the most suitable mixture and to check up the statements and claims made by salesmen.

The Act has just come into operation, and it will naturally be some time before it is in complete working order. Farmers, however, are advised to question stock licks or other stock foods of the type enumerated which are supplied to them without a label as required by the Act. It is in their own interests that the provisions of the Act be enforced and farmers can help by seeing that stock foods that they buy are properly labelled.

In conclusion, it should be noted both by farmers and by manufacturers that any help or advice on the operation of the Act or the general question of stock foods will be willingly given on application to the Chemist of the Department of Agriculture, Melbourne.

LIST OF STOCK FOODS AND STOCK LICKS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE STOCK FOODS ACT 1936, No. 4382, FOR THE YEAR 1937.

Distinguishing Brand Name.	Guaranteed Composition.			Where Obtainable.
	Crude Protein (N × 6·25). Minimum	Crude Fat. Minimum	Crude Fibre. Maximum	
	%	%	%	
CONCENTRATED STOCK FOODS.				
Dried Blood Meal.				
Apex Blood Meal	65·0	..	..	North-Eastern Bone Products, Wangaratta
M.C.C. Blood Meal	66·0	5·0	5·0	Melbourne City Council, Town Hall, Melbourne
Imperial Blood	75·0	..	5·0	W. Angliss and Co. (Aust.) Pty. Ltd., 42 Bourke-street, Melbourne
Meat Meal.				
M.C.C. Meat Meal	63·0	10·0	5·0	Melbourne City Council, Town Hall, Melbourne
T.B. and S. in Diamond Brooklyn Meat Meal	58·0	14·0	..	Thos. Borthwick and Sons (A'asia) Ltd., 84 William-street, Melbourne
Cal-Phoric Meat Meal	58·0	12·0	1·0	Cal-Phoric Stock Foods Co., 430 Little Collins-street, Melbourne
Apex Meat Meal	53·0	7·2	..	North-Eastern Bone Products, Wangaratta
Champion Meat Meal	50·0	12·0	2·0	Sims Cooper (Freezing Works) Pty. Ltd., 499 Little Collins-street, Melbourne
Cockbills Meat Meal	48·0	10·0	1·0	W. and J. Cockbill, 407 Post Office-place, Melbourne
Dandy Meat Meal	45·0	12·0	1·5	Gippsland Co-op. Bacon Curing Co. Ltd., Dandenong
Dandy Poultry Meal	45·0	12·0	1·5	Gippsland Co-op. Bacon Curing Co. Ltd., Dandenong
Apollo Meat Meal	41·0	6·0	2·0	J. Kitchen and Sons Pty. Ltd., Ingles-street, Port Melbourne
Pridham's Meat Meal	53·63	13·37	1·0	W. Pridham Pty. Ltd., Evans-street, Braybrook
Imperial Meat Meal	58·00	9·00	..	W. Angliss and Co. (Aust.) Pty. Ltd., 42 Bourke-street, Melbourne
Imperial Liver Meal	63·00	18·00	..	W. Angliss and Co. (Aust.) Pty. Ltd., 42 Bourke-street, Melbourne
Excelsior Meat Extract Meal	40·00	10·00	..	Rowcroft Bros., 123 William-street, Melbourne
S.M.P. Meat Meal	52·50	9·00	1·50	E. T. Moulden and Son Pty. Ltd., 48 Victoria-street, North Melbourne
PREPARED STOCK FOODS.				
Milk Products.				
Krafco	10·0	·5	..	Kraft Walker Cheese Co. Pty. Ltd., Riverside-avenue, South Melbourne
Kraftone	10·0	·5	..	Kraft Walker Cheese Co. Pty. Ltd., Riverside-avenue, South Melbourne
Rising Sun Buttermilk Powder	35·0	5·0	1·0	Clark, King, and Co. Pty. Ltd., 237 Queen-street, Melbourne
Oil-Seed or Cake Meals.				
Eta Peanut Meal	48·0	1·5	6·0	Nut Foods Pty. Ltd., 544 Lonsdale-street, Melbourne
Linseed Meal	16·6	30·0	9·3	Lyall and Son Pty. Ltd., 39 Leveson-street, North Melbourne
Meggitt's Linseed Oil-cake Meal, M.L.M.	27·0	6·0	13·0	Meggitt's Ltd., Hobsons-road, South Kensington
Meggitt's Linseed Sheep Nuts, M.L.M.	27·0	6·0	13·0	Meggitt's Ltd., Hobsons-road, South Kensington
Sunlight Oil-cake	20·0	5·5	6·5	Lever Bros. Ltd., 565 Flinders-lane, Melbourne
Key Meal	20·0	5·5	6·5	Lever Bros. Ltd., 565 Flinders-lane, Melbourne
Velvet Oil-cake	20·0	5·5	6·5	J. Kitchen and Sons Pty. Ltd., Ingles-street, Port Melbourne
Velvet Oil-cake Meal	20·0	5·5	6·5	J. Kitchen and Sons Pty. Ltd., Ingles-street, Port Melbourne
Eta Cocoanut-cake Meal	19·0	7·0	9·0	Nut Foods Pty. Ltd., 544 Lonsdale-street, Melbourne
MIXED STOCK FOODS.				
Codlivine	17·0	17·0	8·0	Osmond and Son (Aust.) Ltd., 35 William-street, Melbourne
Codlivine (Poultry)	17·0	17·0	8·0	Osmond and Son (Aust.) Ltd., 35 William-street, Melbourne
Codlivine (Pigs)	18·0	16·0	8·0	Osmond and Son (Aust.) Ltd., 35 William-street, Melbourne
Harpers Star Calf Food	12·0	15·0	6·0	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Parsons Calf Food	11·5	14·0	6·5	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Hockings Calf Food	11·1	2·8	3·4	J. Hocking and Sons Pty. Ltd., 243 Dandenong-road, East Malvern
Lyall's Calf Food	10·5	4·2	3·0	Lyall and Sons Pty. Ltd., 39 Leveson-street, North Melbourne
Ayrshire Calf Food	13·35	2·49	3·14	James Railton, 133 Elizabeth-street, South Melbourne
Ward's Calf Food	9·0	3·0	7·0	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Mermaid Growing Mash	16·0	3·5	6·0	National Utility Poultry Breeders' Assoc. Co. Ltd., 537 Flinders-street, Melbourne
Mermaid Chick Mash	11·0	3·5	6·0	National Utility Poultry Breeders' Assoc. Co. Ltd., 537 Flinders-street, Melbourne

LIST OF STOCK FOODS AND STOCK LICKS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE STOCK FOODS ACT 1936, No. 4382, FOR THE YEAR 1937—*continued.*

Distinguishing Brand Name.	Guaranteed Composition.			Where Obtainable.
	Crude Protein ($N \times 6{\cdot}25$). Minimum	Crude Fat. Minimum	Crude Fibre. Maximum	
	%	%	%	
MIXED STOCK FOODS—*continued.*				
Mermaid Laying Mash	16·0	3·5	7·0	National Utility Poultry Breeders' Assoc. Co. Ltd., 537 Flinders-street, Melbourne
Hockings Growing Mash	14·07	5·9	5·2	J. Hocking and Sons Pty. Ltd., 243 Dandenong-road, East Malvern
Hockings Laying Mash	14·05	4·5	4·2	J. Hocking and Sons Pty. Ltd., 243 Dandenong-road, East Malvern
No. 1 Chicken Food (Parsons)	9·5	6·0	4·5	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders lane, Melbourne
Special Chicken Food (Parsons)	9·5	5·0	4·5	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Whites Growing Mash	14·5	3·0	8·0	White, Hancock, and Mills Pty. Ltd., 296–306 City-road, South Melbourne
Whites Eg-a-da	46·5	9·0	1·0	White, Hancock, and Mills Pty. Ltd., 296–306 City-road, South Melbourne
Whites Werribee Chicken Meal	13·0	4·0	3·0	White, Hancock, and Mills Pty. Ltd., 296–306 City-road, South Melbourne
Whites Perfection Chick Food	12·25	3·0	3·0	White, Hancock, and Mills Pty. Ltd., 296–306 City-road, South Melbourne
Whites Monarch Chick Food	12·0	2·5	3·0	White, Hancock, and Mills Pty. Ltd., 296–306 City-road, South Melbourne
Whites Laying Mash	16·0	2·5	8·0	White, Hancock, and Mills Pty. Ltd., 296–306 City-road, South Melbourne
Wards Chick Meal	10·0	4·0	5·0	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Lyalls Laying Mash	13·6	4·3	7·0	Lyall and Son Pty. Ltd., 39 Leveson-street, North Melbourne
Lyalls Werribee Mash	8·4	3·0	6·0	Lyall and Son Pty. Ltd., 39 Leveson-street, North Melbourne
Lyalls Growing Mash	9·0	3·4	7·0	Lyall and Son Pty. Ltd., 39 Leveson-street, North Melbourne
Harper's Star Chick Flakes	10·0	9·0	5·0	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Harper's Star Chick Food	10·0	8·5	5·0	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Clark's Laying Mash	19·0	6·0	6·0	Clark, King, and Co. Pty. Ltd., 237 Queen-street, Melbourne
Clark's Growing Mash	16·0	7·0	6·0	Clark, King, and Co. Pty. Ltd., 237 Queen-street, Melbourne
Clark's Battery Mash	16·0	7·0	6·0	Clark, King, and Co. Pty. Ltd., 237 Queen-street, Melbourne
Skinners Allegg	48·0	5·0	6·0	E. T. Moulden and Son Pty. Ltd., 48 Victoria-street, North Melbourne
Taylors National Calf Food	13·5	6·5	5·5	National Cattle and Poultry Food Co., 64A King-street, Melbourne
Bairds Laying Mash	15·0	5·0	6·0	G. W. and H. P. Baird Pty. Ltd., 15–33 Queens-parade, Clifton Hill
Bairds Growing Mash	13·5	4·5	5·0	G. W. and H. P. Baird Pty. Ltd., 15–33 Queens-parade, Clifton Hill
Warragul Laying Mash	14·05	4·5	4·2	Warragul Egg Circle, Warragul
Warragul Growing Mash	14·07	5·9	5·2	Warragul Egg Circle, Warragul
Vita-lick Pig Mixture (V.P.M.)*	13·2	1·8	3·2	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Vita-lick Mineral Mixture (V.M.M.)*	7·7	7·8	3·1	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Kaf-o-Vite	14·3	12·3	5·6	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
WHEAT AND WHEAT BY-PRODUCTS.				
Mermaid Wheat Meal	10·00	1·5	3·0	National Utility Poultry Breeders' Assoc. Co. Ltd., 537 Flinders-street, Melbourne
Hockings Wheat Meal	12·35	3·0	3·6	J. Hocking and Sons Pty. Ltd., 243 Dandenong-road, East Malvern
Lyalls Wheat Meal	8·20	2·7	3·3	Lyall and Son Pty. Ltd., 39 Leveson-street, North Melbourne
Clarks Wheat Meal	9·00	1·0	3·0	Clark, King, and Co. Pty. Ltd., 237 Queen-street, Melbourne
Bairds Wheat Meal	10·90	2·3	2·5	G. W. and H. P. Baird Pty. Ltd., 15–33 Queens-parade, Clifton Hill
BRAN AND POLLARD.				
The following firms have registered distinguishing brand names for Bran† and Pollard†:—				
Barwon Flour Mills	..	..	..	40 Little Malop-street, Geelong
Brunton and Co. Pty. Ltd.	..	..	..	531 Collins-street, Melbourne
Burnley Flour Mills Pty. Ltd.	..	..	..	376 Swan-street, Burnley
Burrows, John, Pty. Ltd.	..	..	..	Albury, New South Wales
Corowa Milling Co. Ltd.	..	..	..	Corowa, New South Wales
Darling (John) and Son	..	..	..	44 King-street, Melbourne
Echuca Flour Mills Pty. Ltd.	..	..	..	Echuca

* Contains added minerals—phosphates, &c.

LIST OF STOCK FOODS AND STOCK LICKS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE STOCK FOODS ACT 1936, No. 4382, FOR THE YEAR 1937—*continued.*

Distinguishing Brand Name.	Guaranteed Composition.			Where Obtainable.
	Crude Protein (N × 6·25). Minimum	Crude Fat. Minimum	Crude Fibre. Maximum	
	%	%	%	
BRAN AND POLLARD—*continued.*				
Garden City Flour Milling Co. Pty. Ltd.	..	..	..	Trench-street, Ballarat
Grant and Wilson Pty. Ltd.	..	..	..	McNally-street, Yarrawonga
Kimpton (W. S.) and Sons	..	..	..	422 Collins-street, Melbourne
Malcolm (James) and Co. Pty. Ltd.	..	..	..	St. Arnaud
Maryborough Flour Mills Pty. Ltd.	..	..	..	Maryborough
McLennan and Co. Pty. Ltd.	..	..	..	Mooroopna
Miniffe (James) and Co.	..	..	..	422 Collins-street, Melbourne
Noske Bros. Pty. Ltd.	..	..	..	108 Queen-street, Melbourne
Schutt and Barrie Pty. Ltd.	..	..	..	Geelong-road, West Footscray
Silver Lake Flour Milling Co.	..	..	..	Sale
Smith (W. and P.)	..	..	..	35 Cusack-street, Wangaratta
Stratton and Co. Pty. Ltd.	..	..	..	68 Lulie-street, Abbotsford
Sunraysia Flour Mills Pty. Ltd.	..	..	..	Mildura
Thomas (W. C.) and Sons Pty. Ltd.	..	..	..	55 William-street, Melbourne
Tomlins, Simmie, and Co. Pty. Ltd.	..	..	..	Bendigo
Wangaratta Flour Mills Co. Pty. Ltd.	..	..	..	Wangaratta
Water and Kerang United Roller Mills Ltd.	..	..	..	108 Queen-street, Melbourne
Willis Bros.	..	..	..	Kyneton
Wimmera Flour Mill Co. Pty. Ltd.	..	..	..	Stawell
Wise Bros. Ltd.	..	..	..	Tocumwal
The 1937 Chemical Standard for Bran is	14·0	2·5	10·0	
The 1937 Chemical Standard for Pollard is	14·0	3·0	7·0	
OAT PRODUCTS.				
Parsons No. 1 Oat Branning	10·00	6·75	16·0	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Parsons No. 2 Oat Branning	7·50	5·75	15·25	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Harpers Star Oat Branning	9·00	6·00	25·00	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Parsons No. 2 Oat Screenings	8·50	5·50	13·25	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Parsons No. 3 Oat Screenings	7·00	5·00	21·25	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Flemings No. 1 Oat Branning	8·50	5·50	25·00	Fleming and Co. (Aust.) Pty. Ltd., Bunbury-road, Footscray
Wards Oat Branning	6·00	4·00	25·00	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Connell's Oat Branning	11·20	8·50	14·00	John Connell and Co. Pty. Ltd., 578 Bourke-street, Melbourne
Connell's Oat Pollard	11·80	9·00	2·00	John Connell and Co. Pty. Ltd., 578 Bourke-street, Melbourne
Lyall's Oat Pollard	9·60	7·00	7·00	Lyall and Sons Pty. Ltd., 39 Leveson-street, North Melbourne
Hocking's Oat Pollard	12·56	5·10	3·90	J. Hocking and Sons Pty. Ltd., 243 Dandenong-road, East Malvern
Clark's Oat Pollard	12·00	7·00	5·00	Clark, King, and Co. Pty. Ltd., 237 Queen-street, Melbourne
MacKenzie's Oat Pollard	10·00	8·00	5·00	J. F. MacKenzie and Co. Pty. Ltd., 192 Arden-street, North Melbourne
MacKenzie's Oat Branning	7·00	4·00	20·00	J. F. MacKenzie and Co. Pty. Ltd., 192 Arden-street, North Melbourne
BARLEY PRODUCTS.				
Harper's Star Barley Meal	15·0	5·50	2·0	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Ward's Barley Meal	10·0	4·00	10·0	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Lyall's Barley Meal	9·2	2·40	4·3	Lyall and Sons Pty. Ltd., 39 Leveson-street, North Melbourne
Connell's Barley Meal	10·4	4·50	3·0	John Connell and Co. Ltd., 578 Bourke-street, Melbourne
Connell's Barley Branning	10·4	6·00	9·0	John Connell and Co. Ltd., 578 Bourke-street, Melbourne
Harper's Star Barley Branning	14·5	6·50	2·0	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Parson's Barley and Oat Pollard	11·0	5·50	10·0	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Lyall's Barley and Oat Pollard	9·3	4·30	7·0	Lyall and Sons Pty. Ltd., 39 Leveson-street, North Melbourne
MacKenzie Barley Pollard	12·0	3·00	20·0	J. F. MacKenzie and Co. Pty. Ltd., 192 Arden-street, North Melbourne

LIST OF STOCK FOODS AND STOCK LICKS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE STOCK FOODS ACT 1936, No. 4382, FOR THE YEAR 1937—*continued.*

Distinguishing Brand Name.	Guaranteed Composition.			Where Obtainable.
	Crude Protein (N × 6·25). Minimum	Crude Fat. Minimum.	Crude Fibre. Maximum	
	%	%	%	
Rice Products.				
Harper's Rice Bran	5·0	6·0	40·0	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Harper's Star White Rice Meal	10·0	15·0	8·5	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Harper's Star Brown Rice Meal	10·0	20·0	8·5	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Parson's Rice Meal	10·0	19·0	9·5	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
MacKenzies Rice Pollard	10·0	15·0	8·0	J. F. MacKenzie and Co. Pty. Ltd., 192 Arden-street, North Melbourne
Maize Products.				
Polly Gluten Feed	23·0	3·0	9·0	Maize Products Pty. Ltd., corner Parker and Maribyrnong streets, Footscray
Hocking's Maize Meal	8·25	4·25	3·5	J. Hocking and Sons Pty. Ltd., 243 Dandenong-road, East Malvern
Ward's Maize Meal	7·0	3·0	4·0	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Lyall's Maize Meal	7·6	3·2	2·0	Lyall and Sons Pty. Ltd., 39 Leveson-street, North Melbourne
Mermaid Maize Meal	9·0	1·5	4·0	National Utility Poultry Breeders' Assoc. Co. Ltd., 537 Flinders-street, Melbourne
Maize Oil Meal	16·0	12·0	10·0	Maize Products Pty. Ltd., corner Parker and Maribyrnong streets, Footscray
Parsons Wet Maize Bran	3·0	1·0	2·0	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Clark's Maize Meal	7·0	3·0	3·0	Clark, King, and Co. Pty. Ltd., 237 Queen-street, Melbourne
Pea Products.				
Parsons Pea Meal	16·00	1·50	18·75	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Hockings Pea Meal	17·55	2·20	12·95	J. Hocking and Sons Pty. Ltd., 243 Dandenong-road, East Malvern
Wards Pea Meal	14·00	1·00	18·00	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Harpers Whole Pea Screenings	20·00	1·00	5·00	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Harpers Split Pea Screenings	15·00	1·00	5·00	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
Parsons Pea Screenings	16·25	1·00	6·00	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Clark's Pea Meal	18·00	1·00	15·00	Clark, King, and Co. Pty. Ltd., 237 Queen-street, Melbourne
MacKenzie's Pea Pollard	20·00	1·00	10·00	J. F. MacKenzie and Co. Pty. Ltd., 192 Arden-street, North Melbourne
Hulls.				
Parson's Barley Hulls	2·50	·60	39·75	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
MacKenzie's Pea Hulls	6·00	·50	40·00	J. F. MacKenzie and Co. Pty. Ltd., 192 Arden-street, North Melbourne
Parson's Pea Hulls	3·50	·40	46·25	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Parson's Oat Hulls (A)	1·25	·40	40·75	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Parson's Oat Hulls (B)	4·25	3·00	30·00	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Parson's Oat Hulls (C)	5·00	1·25	34·00	Parsons Bros. and Co. Pty. Ltd., 554–562 Flinders-lane, Melbourne
Ward's Barley Hulls	2·00	·80	32·00	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Ward's Pea Hulls	5·00	·25	40·00	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Ward's Oat Hulls	1·50	·70	35·00	H. S. K. Ward Pty. Ltd., 24–38 Spencer-street, Melbourne
Connells Barley Hulls	5·00	·25	18·00	John Connell and Co. Ltd., 578 Bourke-street, Melbourne
Connells Oat Hulls	·50	·50	35·00	John Connell and Co. Ltd., 578 Bourke-street, Melbourne
Flemings Oat Hulls	2·00	1·00	32·50	Fleming and Co. (Aust.) Pty. Ltd., Bunbury-road, West Footscray
Harpers Oat Hulls	2·00	1·00	30·00	Robert Harper and Co. Ltd., 390 Flinders-lane, Melbourne
MacKenzies Oat Hulls	1·50	1·00	35·00	J. F. MacKenzie and Co. Pty. Ltd., 192 Arden-street, North Melbourne
Lucerne.				
Lucerne Meal	12·3	2·4	25·00	Lyall and Sons Pty. Ltd., 39 Leveson-street, North Melbourne

LIST OF STOCK FOODS AND STOCK LICKS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE STOCK FOODS ACT 1936, No. 4382, FOR THE YEAR 1937—*continued.*

Distinguishing Brand Name.	Guaranteed Composition.							Where Obtainable.
	Salt.	Phosphoric Acid.	Lime.	Magnesia.	Iron. (as Fe_2O_3).	Sulphur.	Iodine.	
	% (Max.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (min.)	% (min.)	
STOCK LICKS.								
Common Salt.								
"Lepp" Salt Lick	100·0	..	..	..	..	..	..	J. S. Corden and Co. (Vic.) Pty. Ltd., 44–54 Spencer-street, Melbourne
Cresco Salt Lick, 100 per cent.	100·0	..	..	..	..	..	..	Cresco Fertilizers Ltd., Geelong
Ram Salt Lick, 100 per cent.	100·0	..	..	..	..	..	..	Cheetham Salt Pty. Ltd., 71 Little Malop-street, Geelong
C.F.C. Stock Salt, 100 per cent.	100·0	..	..	..	..	..	..	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
Ram-Lic	97·0	..	..	..	..	3·0	..	Cheetham Salt Pty. Ltd., 71 Little Malop-street, Geelong
Bone Meal, &c.								
Cockbill's Bone Meal	..	21·76	27·60	..	..	..	..	W. and J. Cockbill, 407 Post Office-place, Melbourne
Apex Sterilized Bone Meal	..	25·20	29·80	..	..	..	..	North Eastern Bone Products, Wangaratta
Nuelife Bone Meal	..	24·50	32·00	..	..	..	..	E. F. Peters and Sons Pty. Ltd., Dunolly
G.B.P. Bone Meal	..	23·00	30·00	..	..	..	..	Ronchi Bros., 87 Raymond-street, Sale
Tricalos Sterilized Bone Flour	..	30·00	40·00	..	..	..	..	Glues and By-Products Pty. Ltd., 86 King-street, Melbourne
Cockbill's Bone Grit	..	20·00	25·27	..	..	..	..	W. and J. Cockbill, 407 Post Office-place, Melbourne
Miscellaneous.								
C.F.C. Di-Calcic Phosphate	..	37·50	29·57	..	..	..	..	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
C.F.C. Di-Calcic Lick, No. 1	65·00	9·38	7·39	..	..	..	..	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
C.F.C. Di-Calcic Lick, No. 2	71·00	5·63	4·44	1·00	·29	5·00	..	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
C.F.C. Di-Calcic Lick, No. 2 (with Iodine)	71·00	5·63	4·44	·49	·29	5·00	·05	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
C.F.C. Di-Calcic Lick, No. 3	..	23·44	18·48	2·03	1·20	20·83	..	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
C.F.C. Di-Calcic Lick, No. 3 (with Iodine)	..	23·44	18·48	2·03	1·29	20·83	·19	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
C.F.C. Bone Lick (with Iodine)	61·00	6·53	8·28	·49	·29	5·00	·05	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
C.F.C. Ground Phosphate	..	36·65	49·50	..	..	..	..	Commonwealth Fertilizers and Chemicals Ltd., 65 William-street, Melbourne
Cresco Di-Calcic Lick, No. 1	65·00	6·50	6·50	..	..	..	..	Cresco Fertilizers Ltd., Geelong
Cresco Di-Calcic Lick, No. 2	71·00	3·80	3·80	·30	·20	4·50	·04	Cresco Fertilizers Ltd., Geelong
Cresco Di-Calcic Lick	90·00	2·50	2·50	..	..	..	..	Cresco Fertilizers Ltd., Geelong
Cresco Concentrated Di-Calcic Lick	..	25·00	25·00	..	..	..	..	Cresco Fertilizers Ltd., Geelong
Cresco Calcium Phosphate Lick	65·00	1·30	16·00	..	..	..	..	Cresco Fertilizers Ltd., Geelong
Cresco Calcium Phosphate Copper Lick	58·00	1·30	18·50	..	..	..	..	Cresco Fertilizers Ltd., Geelong
Cresco Calcium Phosphate Copper Iodine Lick	67·50	1·30	13·50	..	..	..	·35	Cresco Fertilizers Ltd., Geelong
Cresco Calcium Copper Lick	65·00	..	16·00	..	..	..	..	Cresco Fertilizers Ltd., Geelong
Cresco Calcium Copper Iodine Lick	65·00	..	15·90	..	..	..	·35	Cresco Fertilizers Ltd., Geelong
Vic-Lic Concentrated D	..	28·77	30·57	..	4·28	..	Trace	Wilcox Moffin Ltd., Henty House, 499 Little Collins-street, Melbourne
Vic-Lic Concentrated G	..	29·02	31·10	..	7·37	..	Trace	Wilcox Moffin Ltd., Henty House, 499 Little Collins-street, Melbourne
Vigoreen Concentrate	15·00	11·00	16·80	1·95	1·50	6·00	·09	Victor Leggo and Farmers Ltd., 222 Queen-street, Melbourne
Osmond's Concentrated Lick	..	12·0	7·00	1·3	·6	2·0	·04	Osmond and Son (Aust.) Ltd., 35 William-street, Melbourne

LIST OF STOCK FOODS AND STOCK LICKS REGISTERED AT THE OFFICE OF THE DIRECTOR OF AGRICULTURE UNDER THE STOCK FOODS ACT 1936, No. 4382, FOR THE YEAR 1937—*continued.*

Distinguishing Brand Name.	Guaranteed Composition.							Where Obtainable.
	Salt.	Phosphoric Acid.	Lime.	Magnesia.	Iron. (as Fe_2O_3).	Sulphur.	Iodine.	
STOCK LICKS—*continued.*	% (Max.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (min.)	
Miscellaneous.—continued.								
Osmond's Toneea Stock Lick ..	75·0	6·0	2·50	·2	·3	2·5	·04	Osmond and Son Aust.) Ltd., 35 William-street, Melbourne
Lixit	60·0	7·0	10·00	·25	·5	5·0	·04	A. S. Miller, Queen-street, Ararat
Salvitis Lick	90·0	1·8	2·80	·2	·8	·4	..	New Salvitis Pty. Ltd., 366 Swan-street, Burnley
Salvitis Concentrate	..	18·8	28·10	·2	8·4	4·4	..	New Salvitis Pty. Ltd., 366 Swan-street, Burnley
Apex Concentrate	5·0	17·64	20·86	5·00	2·0	6·0	..	North Eastern Bone Products, Wangaratta
C. and B. Tonic Mineral ..	63·0	12·00	9·50	·70	·4	7·7	..	J. S. Brewer, Rossiter's-road, Koowee-rup
Calphosfer	..	28·70	33·50	·20	7·5	..	..	Hamilton Laboratories Pty. Ltd., 532 Bourke-street, Melbourne
C-Lik	22·0	8·00	20·00	4·00	3·0	..	..	Deepsea Stock Foods, 527 Collins-street, Melbourne
Mineralox	22·0	8·00	20·00	4·00	3·0	..	..	Deepsea Stock Foods, 527 Collins-street, Melbourne
Vita Lick Concentrated D ..	..	13·00	17·30	1·30	1·7	8·0	Trace	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Vita Lick Concentrated G ..	..	19·50	25·90	1·30	1·7	8·0	Trace	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Vita-Lick Mixed D	75·0	2·40	3·20	·25	·33	1·5	Mere Trace	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Vita-Lick Mixed G	75·0	3·67	4·93	·25	·33	1·5	Mere Trace	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Vita-Lick Extra Strength Mixed D	62·0	4·00	5·35	·40	·55	2·5	Mere Trace	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Vita Lick Extra Strength Mixed G	62·0	6·10	8·10	·40	·55	2·5	Mere Trace	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Por-co-vite	30·0	14·00	24·20	·83	·30	10·0	Trace	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Chic-a-vite	..	20·70	27·60	1·43	1·80	1·8	Mere Trace	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Vita Lick Mineralized Block ..	82·0	2·15	4·90	·83	·10	..	..	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Carbophos Mineralized Block ..	77·0	4·30	7·75	·80	·10	..	..	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Vita Lick Red Blocks ..	82·0	2·15	4·90	·83	·55	..	Merest Trace	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Vita Lick Cattle Lick Concentrated D	1·0	15·77	20·50	1·33	·90	2·10	Trace	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Vita Lick Cattle Lick Concentrated G	1·0	20·55	26·70	1·33	1·80	2·10	Trace	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Vita Lick Cattle Lick Mixed D ..	74·0	2·84	3·70	·24	·17	·39	Merest Trace	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Vita Lick Cattle Lick Mixed G..	74·0	3·76	4·91	·24	·35	·39	Merest Trace	Vita-Lick Pty. Ltd., 493–495 Collins-street, Melbourne
Foddalik (FL in square) ..	..	13·00	27·60	5·60	1·10	..	Merest Trace	The Mineral Foods Co. of Australia Pty. Ltd., Henty House, Little Collins-street, Melbourne
Wagstaff's Medicated Salt Compound	59·2	6·50	8·50	Trace	·37	3·20	·04	B. Wagstaff, 568 Bridge-road, Richmond
Wagstaff's Mineral Concentrate	..	19·00	26·20	·65	1·55	14·20	..	B. Wagstaff, 568 Bridge-road, Richmond
Allkon Block Lick	91·0	1·90	3·00	..	Trace	..	..	Allkon Pty. Ltd., 34 Queen-street, Melbourne
Allkon Lick, No. 1	5·0	19·00	30·00	..	·30	..	Trace	Allkon Pty. Ltd., 34 Queen-street, Melbourne
Immunolic Concentrate ..	5·0	19·00	30·00	..	·30	..	Trace	Hart and Co. Pty. Ltd., 72–86 Whiteman-street, South Melbourne
Immunol Block Lick ..	91·0	1·90	3·00	..	Trace	..	..	Hart and Co. Pty. Ltd., 72–86 Whiteman-street, South Melbourne
Allkon Lick, No. 2	8·0	15·00	25·00	..	·30	1·0	Trace	Allkon Pty. Ltd., 34 Queen-street, Melbourne
Allkon Organic Lime Compound	..	..	7·00	..	..	..	..	Allkon Pty. Ltd., 34 Queen-street, Melbourne
Allkon Special Organic Lime Compound	..	..	7·00	..	..	..	..	Allkon Pty. Ltd., 34 Queen-street, Melbourne
Vic-Lic Mixed G	78·0	5·50	6·00	..	1·4	..	Trace	Wilcox Mofflin Ltd., Henty House, 499 Little Collins-street, Melbourne
Vic-Lic Mixed D	78·0	5·50	6·00	..	·7	..	Trace	Wilcox Mofflin Ltd., Henty House, 499 Little Collins-street, Melbourne
Vic-Lic Concentrated	5·0	29·02	31·10	..	4·28	..	Trace	Wilcox Mofflin Ltd., Henty House, 499 Little Collins-street, Melbourne

W. R. JEWELL, M.Sc.,
Chemist for Agriculture.

Melbourne, 22nd June, 1937.

Orchard and Garden Notes

THE planting of trees and shrubs, if it is to take place this winter, should not be delayed further. There are few gardens that cannot be improved by a judicious introduction of such perennials and a balanced collection of deciduous and evergreen shrubs, spring, summer, and autumn flowering, or richly tinted in foliage, should provide at least one interesting feature in the garden practically throughout the year. Any reliable nurseryman will advise on the suitability of the large number of plants available. Care should be taken in planting that the ground is well dug, and this particularly applies to the hole in which the shrub or tree is to be actually planted. In heavy soil it should not be too deep, as it may encourage "wet feet." Leaf mould or a little blood and bone or castor meal fertilizer should be mixed with the soil at the base, for such plants, as compared with the annuals, are comparatively deep rooting, and fertilization of the lower soil layers after planting is more difficult.

One should always be ready to remodel a shrubbery if necessary. Frequently one sees plants that have outgrown their position and they remain in the garden because of a very general hesitancy to remove a relatively permanent feature. Much interest, however, can be added to the garden if the plants can be changed occasionally as opportunity offers.

The planting of bulbs in between the shrubs is a practice which should be fostered, for the two blend very well together. It is too late to plant most bulbs now, but flag irises are an exception and will do well in any sunny, well-drained situation.

Annuals for spring flowering may still be planted.

The pruning of summer and autumn flowering shrubs may also be done, but the spring flowering sorts should not be touched until after they have bloomed. Roses should also be pruned, and, although many people fear the intricacy of this operation, it is really not very difficult. The first essential is to remove

Iris Stylosa.

weak and thin old wood and crossing shoots, leaving only a shapely well-spaced set of leaders open in the centre to permit adequate sunshine in the centre of the bush. All leaders should be cut back to a strong bud pointing in the direction in which it is desired that the new growth should proceed.

If you have a flowering peach do not fail to spray it with Bordeaux mixture, 6.4.40, just before bud burst for control of peach leaf curl, a most depressing sight in any garden and a comparatively easy trouble to overcome by spraying.

The Orchard.

Pruning is now going on, and early pruning, where possible, is always desirable, except for varieties of peaches which tend to shed their blossoms. These should be pruned very late.

Pruning is by no means a rule of thumb, although many people appear to consider it as such; it is really just a matter of common sense. If you do not already know, be sure to discuss with someone who does, the actual fruiting habit of your trees, the type and age of the wood on which the fruit is borne, and just how to encourage the growth of such wood by the pruning practised. Without such knowledge, it is not possible to prune intelligently.

Again, seasonal differences resulting in various numbers of fruit buds per tree demand different pruning methods from year to year. Study this aspect before you commence the work.

If you desire to re-work trees a little later on do not forget to carefully heel in the freshly cut prunings of any varieties you desire as scions.

Shelter from wind is a prime essential in Victorian orchards, and growers should now be planting wind-breaks where necessary. Do not under estimate the importance of this. If you desire advice as to suitable trees write to the Department.

During the winter months attention should be given to drainage, both surface and underground. It is of great value to dig a hole for observation purposes in any part of the orchard suspected of being wet. If you find that it is wet, do not hesitate to decide upon and put into effect suitable remedial measures.

Winter measures for pest control are an important feature. Scrupulous orchard hygiene is the first necessity. Rough barked trees, fence posts, props, sheds, cases, &c., should be attended to, for they harbour innumerable orchard pests.

The dormant tree can be sprayed with solutions stronger and more toxic than can be applied in the growing season. To destroy the eggs of aphids, tar distillate at a strength of 1 gallon in 35 of water will be found effective. For black peach aphid, tangle foot may be placed around the tree trunks during July to trap the insect when it migrates from the roots to the tree tops in early spring. Red spider and San José scale can be effectively controlled by winter sprays of lime sulphur 1 gallon to 9 of water, or red oil 1 gallon to 15 of water.

Fruit in cool store should receive occasional observations even if it is not to be marketed yet. Frequently the Department is asked for advice when troubles have reached an advanced stage, and growers should realize that it is very much more helpful and easy to have early notification of the onset of storage troubles.

The Kitchen Garden.

Mushroom growing is now a popular pastime. Pure cultures of spawn are available from dealers, and it may be sown at any time. Prepared beds are made of horse manure well mixed for a week or two. Small portions of spawn are regularly spaced in the beds and covered over. The beds must be in semi-darkness, protected from rain, and well drained. Full directions for mushroom growing will be supplied on application to this Department.

Mushrooms grown from artificially produced spawn and beds are perfectly safe and palatable to eat at any time of the year.

Final preparation of beds for sowing of peas and broad beans should be made now. The ground should be well limed and any available animal manure or garden litter well worked into the soil. Varieties of peas include Yorkshire Hero, which has been satisfactory for a long time, and the more recently popular introductions, Greenfeast and Melbourne Market. The latter is a very fast grower, germinating much more quickly than Greenfeast. It is similar to Yorkshire Hero, but does not stool out so freely. Melbourne Market has broader pods than those of Greenfeast, and is very productive; it is a tall-growing type, and must be staked when grown in the home garden.

Book Review

The Scientific Principles of Plant Protection with Special Reference to Chemical Control. By H. Martin, 2nd Edition. London. Edward Arnold and Co. 1936.

The second edition of this very useful book, which is almost entirely revised, follows the same general plan as that of the first edition published in 1928.

Dr. Martin in his book surveys very clearly the methods at present available for plant disease and pest control and the principles underlying these methods.

Special consideration has also been given to a large number of new compounds evolved by synthetic chemistry, which have been found to possess insecticidal and fungicidal properties.

This book not only presents the most recent advances made in this regard, but also the author has succeeded in moulding together the chemical and biological view-points on this important field of study. S.F.

Professional Papers

[This section is devoted to professional papers and articles of a scientific character.]

Irrigation of Sultanas in the Swan Hill District

* By F. Penman, M.Sc., J. K. M. Skene, M.Agr.Sc., and D. V. Walters, B.Agr.Sc.

SUMMARY.—Soil moisture properties and irrigation practices have been investigated for a number of soil types carrying sultanas in the Swan Hill district. Rate of loss of soil moisture and efficiency of irrigation as judged by the wetting of soil have been studied.

Impeded penetration of irrigation water through the subsoils of several of the major soil types of the area has been noted as an important factor in the irrigated horticulture of the district. In this connexion rational use of water and application of methods designed to improve soil permeability have been stressed. Recommendations providing a basis for irrigation technique on individual soil types are given.

SOIL survey work was carried out at Woorinen during 1928(1), and in later years similar information was obtained for adjoining settlements in the Swan Hill district. The areas concerned(2, 3) included Nyah, Tresco, Tresco West, Kangaroo Lake, and Murrabit, on the Victorian side of the Murray River, and Bungunyah and Goodnight in New South Wales. As certain soil types were shown to be common to several of the localities mentioned, a sound basis was provided for application of results of experiment on specific soils in one settlement to related soils throughout the district.

It was considered by many growers at Woorinen that a permanent committee should be formed with the object of utilizing to best advantage the data obtained by the soil survey. This settlement being devoted largely to the growth of vines, the proposed organization would make available to block-holders any information tending towards improvement in yield and quality of dried fruit. In 1931 a committee was constituted at Woorinen to meet these requirements, and association with similar bodies in neighbouring settlements soon followed.

The Nyah-Woorinen Dried Fruits Enquiry Committee, as it was called finally, includes representatives of the various local bodies, of the Commonwealth Council for Scientific and Industrial Research, and of the Victorian State Rivers and Water Supply Commission and Department of Agriculture. Under the auspices of this committee, a scheme of investigation was put into operation in 1932. This was designed to give information along the two broad lines of viticultural practice and irrigation method. Officers of the Merbein Station of the Council for Scientific and Industrial Research have conducted the viticultural inquiry, while the soil work has been contributed mainly by the Victorian Department of Agriculture, with the co-operation of the Council for Scientific and Industrial Research.

Scope of Investigations.

The present report deals with irrigation investigation from the soil aspect, chiefly in the period 1932 to 1934. The aim of the work has been to establish principles for guidance in the use of irrigation water on the major soil types of the dried fruit areas in the vicinity of Swan Hill.

Investigation was carried out chiefly at Woorinen and Nyah, particular attention being given to the soil type Tatchera Sandy Loam, which occurs extensively in several of the settlements mentioned above. In addition to this soil, the types Tatchera Sand, Vinifera

* Messrs. Penman and Skene are officers of the Victorian Department of Agriculture and Mr. Walters is an officer of the Commonwealth Council for Scientific and Industrial Research, at the Merbein Research Station, Victoria.

Loam, Nyah Clay Loam, Woorinen Loam, and Beverford Clay Loam were examined in relation to irrigation requirement, while exploratory work in this respect was carried out on Bungunyah Clay and Koraleigh Sandy Loam.

Moisture Properties of Soil Types.

In order to interpret the results of determinations of soil moisture content, it is necessary to allow for differences in texture and other properties between various samples of soil. For this reason, determination of some soil moisture "constant" for each sample examined is desirable, so that the actual moisture content found in the sample may be evaluated on a comparative basis. Laboratory determinations which have been made for this purpose in the present work are "sticky point" and "wilting coefficient," while "field capacity" measurements provide "constants" dependent on the actual field properties of the soils.

"Sticky point" is the moisture content at which, during gradual drying of kneaded moist soil, it just ceases to adhere to external objects. Such determinations reflect the colloidal properties of the soil, so that in types like those at Nyah and Woorinen, relatively low in organic matter, they may be accepted as expressive of the amount and character of the clay present.

"Wilting coefficient" of a soil is the moisture content at or below which plants grown in it remain wilted even when placed in an atmosphere saturated with water vapour, and do not regain turgidity unless water is added to the soil. On certain soil samples concerned in the present work, direct determination of wilting coefficient was made, using seedling wheat as an indicator plant. These values agreed well with those calculated from sticky point by means of a formula developed by Walters for Merbein soils(4). As it was not possible to make direct determinations of wilting point in all cases, calculated figures have been used throughout in presentation of wilting coefficient data.

"Field moisture capacity" is the moisture content of a soil following attaining of equilibrium by natural drainage after thorough wetting under field conditions. In the present work, sampling for field capacity determination was restricted to the cooler periods of the year, and was carried out six to eight days after irrigation. Ordinary large-scale irrigation was used for these tests, and also watering of localized areas at each site by confining a 12-in. head of water in a bottomless drum with the lower rim forced below the soil surface. After penetration of water in these latter tests, the surface soil was protected from evaporation. In assessing field capacity, no account was taken of those irrigations after which high water tables were observed.

Soil moisture work has been carried out on eleven sites distributed over the six main soil types of Woorinen and Nyah. Figures for the moisture "constants" are set out in Table I. for each soil type, these being derived from samples in 6-in. sections to a total depth of 3 feet, and each representing a considerable number of individual determinations.

TABLE I.—REPRESENTATIVE MOISTURE "CONSTANTS" FOR THE SOIL TYPES AT VARIOUS DEPTHS.

(*Figures are Moisture Percentages on Dry Soil Basis.*)

Soil Type.	Tatchera Sand.			Tatchera Sandy Loam.			Vinifera Loam.			Nyah Clay Loam.			Woorinen Loam.			Beverford Clay Loam.		
Sites.	N.			W, W, N.			N.			N, N.			W, W.			W, W.		
	S.P.	F.C.	W.P.	S.P.	F.C.	W.P.	S.P.	F.C.	W.P.	S.P.	F.C.	W.P.	S.P.	F.C.	W.P.	S.P.	F.C.	W.P.
0″ to 6″..	19·5	15·3	9·1	21·0	19·9	10·3	15·8	17·8	6·2	24·2	23·1	12·8	20·7	23·2	10·1	30·1	26·5	17·5
6″ to 12″..	21·5	16·5	10·7	26·1	21·6	14·3	23·9	22·8	12·6	27·0	24·8	15·0	29·7	26·2	17·2	31·2	25·5	18·3
12″ to 36″..	21·7	16·3	10·9	27·1	23·3	15·1	26·3	23·8	14·5	29·0	24·9	16·6	31·4	25·1	18·5	32·5	25·3	19·4
0″ to 36″..	21·3	16·2	10·5	25·9	22·5	14·2	24·1	22·6	12·8	27·9	24·6	15·7	29·4	25·0	16·9	31·9	25·5	18·9

"Sites" shows the number of locations contributing to the representative figures recorded and the settlement in which each occurs, "N" and "W" signifying Nyah and Woorinen respectively. S.P., F.C., and W.P., denote sticky point, field capacity, and wilting point respectively.

TABLE II.—USEFUL MOISTURE RANGES FOR THE SOIL TYPES—0 TO 36 INCHES.

	Tatchera Sand.	Tatchera Sandy Loam.	Vinifera Loam.	Nyah Clay Loam.	Woorinen Loam.	Beverford Clay Loam.
As percentage of dry soil	5·7	8·3	9·8	8·9	8·1	6·6
As acre-inches of water	3·3	4·8	5·7	5·1	4·7	3·8

Differences in the moisture properties of the various soil types are at once evident from the figures of Table I. Wide contrasts are noted, for example, between Beverford Clay Loam and Tatchera Sand, the extremes in texture among those examined. Relations such as these are in general conformity with differences in textural properties between the soil types, an exception being that the Vinifera Loam site carries soil too light, especially at the surface, adequately to represent this type.

Grouping into the depths shown in Table I. brings out an important feature of certain of these soil types. Comparison of sticky points for 0 to 6 inches with those for 0 to 36 inches shows that in all types there is the usual tendency towards rise with increasing depth, in accordance with greater clay content in the subsoil. The figures for 0 to 6 inches, 6 to 12 inches, and 12 to 36 inches show, however, that there are two groups of soil types; the first comprising Tatchera Sand, Nyah Clay Loam, and Beverford Clay Loam, in which the change is relatively small and gradual, and the second, including Tatchera Sandy Loam, Vinifera Loam, and Woorinen Loam, in which the change is greater in extent and sharper in character, in that most of it occurs within a foot from the surface. As sticky point averages for the groups, the change on passing from the 0 to 6-in. to the 6 to 12-in. zone is only from 24.6 to 26.6 per cent. for the first group, while in the second it is from 19.2 to 26.6 per cent. These figures reflect structural differences in the profiles of the two groups of soil types, this relatively sharp change, close to the surface, in the moisture properties of the second group, having an important bearing on the behaviour of these soils under irrigation.

Field capacity values, as shown in Table I., are generally about 2 to 3 per cent. lower than the corresponding sticky points, but Tatchera Sand and Beverford Clay Loam show wider differences, up to 6 per cent. Wilting coefficients naturally run parallel with the sticky points.

As a soil must be maintained above wilting point to ensure that water is available readily to plants, it is evident that the difference between field capacity and wilting coefficient represents the useful moisture range of the soil. Again, this difference gives an indication of the amount of irrigation water which may be required to replace losses from the soil, since soils are rarely taken appreciably below wilting point to any considerable depth in normal irrigation practice. Table II. shows these differences for the 0 to 36-in. depth for each soil type as obtained by using the figures given in Table I., and also shows this useful moisture range expressed approximately as acre-inches of water.

The table shows that Vinifera Loam is capable of holding most water available to plants, and Tatchera Sand least. Differences between Tatchera Sandy Loam, Nyah Clay Loam, and Woorinen Loam are slight, while low field capacity is reflected in the figure for Beverford Clay Loam, which is relatively small for a heavy soil of this kind.

Together with information concerning the rate of loss of soil moisture from the various soil types, the data concerning moisture "constants" indicates the length of time which may elapse on individual soils between irrigations, without injury to vines due to lack of available moisture.

SEASONAL VARIATIONS IN SOIL MOISTURE.

The object of the work on soil moisture was to investigate the efficiency of irrigation methods as practised in the district, from the aspects of most effective times and methods of application of water, and penetration and general distribution of water in the soil after irrigation.

PROCEDURE.

During the 1932-33 season, three sites at Woorinen and two at Nyah were investigated,

while in the following season three sites were used at each of these settlements, giving a total of eleven different locations. Each site was on an area of considerable size of a particular soil type as defined by the soil survey, and the locations were such as to give reasonable geographical distribution over the two settlements. Sites were of varying sizes, up to that of an area enclosed by eight rows of vines, with a run of about 3 chains down the rows. Irrigation water was applied in three furrows per row on all sites concerned with soil moisture determination.

Systematic soil sampling was carried out at each site before and after irrigation throughout the season, samples being taken in 6-in. sections to 3 feet, which was considered the limit of effective vine-root penetration. In addition, in the 1932-33 period, weekly samples were taken from the Tatchera Sandy Loam site to provide information on the rate of loss of soil moisture, between irrigations, from the most extensive soil type of the district.

In the second season it was the usual practice to make four bores per site on each sampling occasion, samples being analysed separately, and mean values for soil moisture for each depth calculated, with standard deviation to test significance of differences between means for different occasions. During the first season, only one bore per site was used at each sampling, but sticky point as well as actual moisture content was determined for each sample. This enabled adjustment for texture variations of the actual moisture contents of individual samples by use of the sticky point figures, thus reducing soil moisture results to a comparable basis.

In statistical examination, the weekly figures for Tatchera Sandy Loam were treated as one group, while a second group dealt with the figures for soil moisture immediately before, and just after, irrigation on the following sites—Tatchera Sandy Loam, Nyah Clay Loam, Woorinen Loam, and Beverford Clay Loam. In each group, correlation between actual soil moisture and sticky point was examined, using the method of analysis of co-variance(5). The factors examined in analysis of co-variance of weekly figures for Tatchera Sandy Loam, for example, were irrigations, times after irrigation, depths, interactions between these, and higher order interactions, the latter providing an estimate of the regression of soil moisture on sticky point. Using this regression coefficient(3), the actual soil moisture figures were adjusted in accordance with the following formula:—

Adjusted soil moisture = actual soil moisture — b (actual sticky point— sticky point general mean).

The adjusted values were examined by tests of significance with reduced variance, and various mean values were calculated for presentation of the data. Several graphs using these means are shown later. The authors record their appreciation of the advice given by Miss F. E. Allen, Division of Plant Industry, Council for Scientific and Industrial Research, to D. V. Walters, in connexion with this statistical treatment.

Samples for soil moisture work were taken by means of a post-hole digger, and were despatched in lever-lid tins to the laboratory, the whole sample being used for moisture determination. In both seasons composite samples for particular depths were made from the individual samples taken throughout the season, the composites being examined to determine moisture "constants."

An important phase of the work on soil moisture was that of penetration of irrigation water applied to the various types of soil. This was studied on all soil moisture sites, and also on several sites which were not used for systematic soil moisture sampling. For experiments on penetration of irrigation water, and determination of penetration profiles, attempts were usually made to measure the amount of irrigation water applied. Various numbers of furrows per row were examined, and penetration profiles were made by tracing out the spread of irrigation water from the furrows after irrigation by digging pits across the furrows.

During the second season test wells were installed on all soil-moisture sites. Not less than six test wells, each 6 feet deep, were installed on each site. Test-well records of the depth of the free water from the soil surface were taken throughout the year, in greater detail in the irrigation season than at other times. Most of the sampling and reading of test wells was done by Mr. R. C. Polkinghorne, local part-time officer of the Council for Scientific and Industrial Research, and secretary of the Nyah-Woorinen Enquiry Committee, whose interest and efficiency have been of great help in this and other investigatory work in the district.

Individual Soil Types.

Tatchera Sand.

Soil moisture studies carried out in the 1932-33 season, on a Tatchera Sand site (location 1), at Nyah, provide an illustration of the ease with which over-watering may be developed in soils of this kind. The site was at the head of the irrigation run, as is usual with the lighter soils in this district. Throughout the season this soil was rarely below field capacity, considering an average for the upper 3 feet. For this depth of soil, with field capacity at 16.2 per cent., and wilting point at 10.5 per cent., values for soil moisture six days after irrigation were fairly uniformly about 21 per cent., while samples taken approximately 27 days after irrigation, just prior to the succeeding watering, ranged around 16 per cent. It is evident, therefore, that this soil was saturated for the greater part of the season. Nevertheless, no definite adverse effect on the vines was noted.

Typical irrigation procedure on this soil was the use of two furrows per row, running for about 18 hours, but waterings up to 48 hours were used at times. The moisture results indicate the necessity for attention to rapid watering and short length of run in irrigation of soils of this character.

Tatchera Sandy Loam.

1932-33.—The chief work in the 1932-33 season on this soil type was an investigation at weekly intervals of the fluctuations in soil moisture status on a Woorinen site (location 3). Vine growth on this site was normal throughout the period of examination.

With regard to the general loss of soil moisture between irrigations, as an average

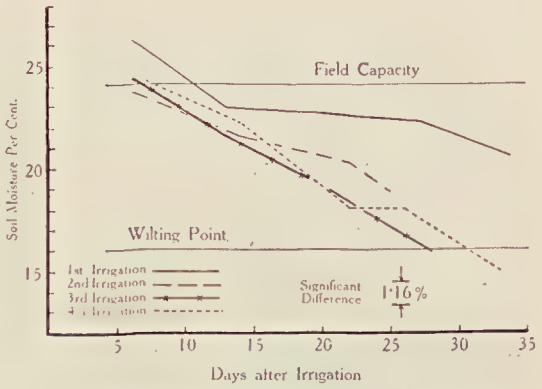


Fig. 1.—Illustrating the influence of the stage in the irrigation season on rate of loss of moisture from Tatchera Sandy Loam 0 to 36 inches.

over the whole season, it was found that for the 0 to 36-in. depth, a loss of 0.33 per cent. per day between 6 and 14 days after irrigation is followed by one of 0.31 per cent. between 14 and 21 days, falling to 0.20 per cent. between 21 and 27 days. This expresses the slackening of rate of loss of soil moisture as the soil dries from values approaching field capacity to those approaching wilting point.

Fig. I. shows the influence of the stage in the irrigation season on rate of loss of soil moisture, 0 to 36-in. values for individual irrigations being shown separately. The important point illustrated here is the greatly increased rate of loss in the later irrigations as compared with the first. The graph shows that the soil approximates to wilting point at 28 days after the third and fourth irrigations, indicating that four weeks is the maximum inter-irrigation period for this soil type in

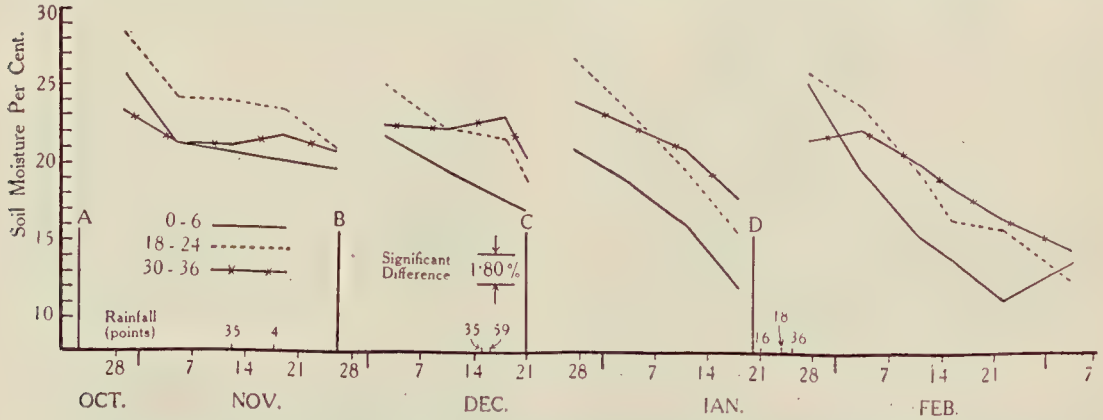


Fig. 2.—Moisture fluctuations at three representative depths of Tatchera Sandy Loam throughout the 1932–33 irrigation season. Vertical lines A, B, C and D indicate dates of irrigations.

the summer. The influence of advancing season is shown also by figures for the average moisture status of the soil in the periods between the various irrigations—these are, as percentages of dry soil for 0 to 36 inches, 23.5, 21.1, 20.2, 20.7, respectively, with 0.52 as a significant difference.

Relations between the various soil zones down to 36 inches are of considerable interest. Fig. 2 shows in detail the nature of soil moisture fluctuations throughout the season at three representative depths, while Fig. 3 shows the losses of moisture from individual zones between irrigations as averages for the whole watering season. Fig. 2 indicates that there is little demand by the vine for water until early December, discounting the initial fall until twelve days after the first watering, due to over-saturation at that time. After the second irrigation, losses of moisture increase significantly down to 2 feet, soil below this depth

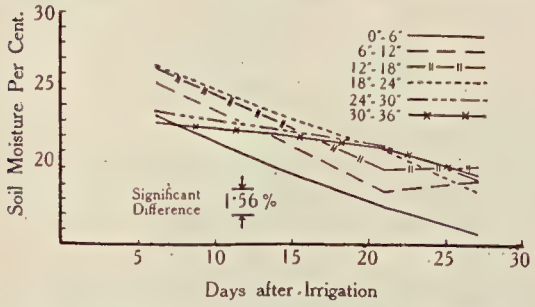


Fig. 3.—Moisture losses between irrigations from various depths of Tatchera Sandy Loam as averages for the whole irrigation season 1932-33.

showing no significant depletion until after 18th December. In the period January to March, losses are greatly increased, moisture being readily lost from all zones down to 36 inches.

Fig. 3 brings out more clearly the point shown also by Fig. 2, that moisture fluctuations are wider in the surface 6 inches than in other zones. This graph indicates the importance of the 18 to 24-in. zone in maintaining a steady supply of water to the vine. Above this zone, the soil shows considerable moisture loss until 21 days after irrigation, falling to values approaching to wilting point, but thereafter shows no further significant loss, except in 0 to 6-in. section, this latter probably being due to surface evaporation. Below 24 inches, the soil does not show significant loss until after 21 days, but in the period 21 to 27 days after irrigation the 24 to 36-in. sections make significant contribution, together with 18 to 24-in. zone, to the water requirements of the vines.

The work on this site emphasizes the desirability for light waterings in late spring, and frequent watering in January and February, with particular attention to ensuring effective wetting down to the full depth of 3 feet so that the lower zones will be able to maintain water supply to the vines in the later stages of the inter-irrigation periods.

1933-34.—In the following year further work along similar lines was carried out on Tatchera Sandy Loam, with one site at Nyah (location 4), and a further Woorinen site (location 2).

The soil of the Woorinen site was lighter than that at location 3, tending towards Tatchera Sand type, and the site was situated on a rise. It was not considered likely that any over-watering problem would be in evidence on this site. Actually, however, the soil profile shows to marked degree the rapid change relatively near the surface described in an earlier section, sticky points in 6-in. depths from the surface to 18 inches, being as follows:—16.2, 25.6, and 27.5 per cent. Probably this structural character of the profile, together with over-watering, accounts for the elevated water table found on this site for the greater part of the irrigation season.

Fig. 4A sets out the results of test-well readings on this location, showing remarkably high perched water tables after irrigation, the level dropping at the rate of about 1.3 inches per day to below 3 feet. Indications are that over-watering took place at irrigations other than the fourth, because, while there was very slight elevation of the water table on this occasion, soil moisture determinations revealed that the fourth irrigation was efficient, soil being wetted slightly above field capacity down to 36 inches. This suggests that careful control of watering would remedy this situation of elevated water table without limiting effective water supply to the vines. During the period of systematic observation no visible damage to the vines ensued from the conditions described.

Considered over the whole season, the soil moisture figures show the usual large fluctuation in the surface 6 inches, and relatively low general losses until January—from the end of November this location went 40 days without further irrigation, when the soil approached wilting point in all zones to 36 inches. For the 0 to 36-in. depth, soil

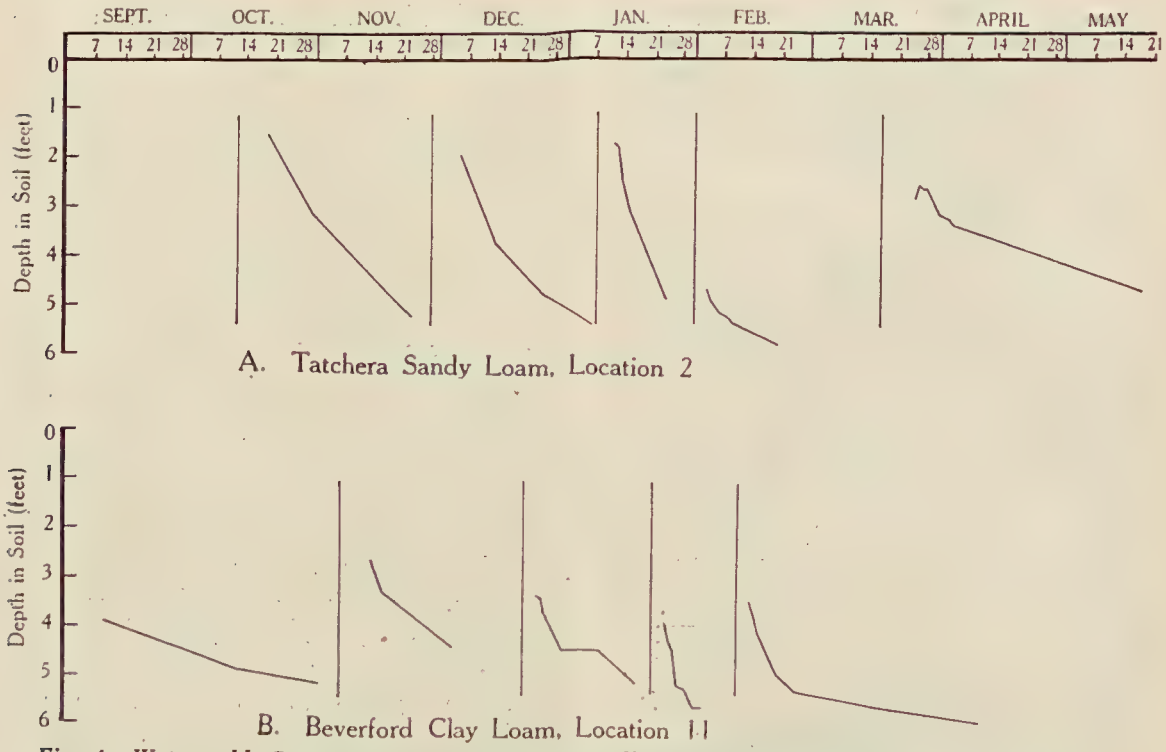


Fig. 4.—Water-table fluctuations as shown by test wells in A, Tatchera Sandy Loam and B, Beverford Clay Loam. Vertical lines show dates of irrigations.

moisture four to six days after irrigation ranged from 25.0 to 20.7 per cent., compared with a field capacity of 22.2 per cent., and samples taken prior to irrigation ranged down to 13.9 per cent., compared with wilting point of 13.7 per cent. This soil showed slight but significant losses in 18 to 36-in. sections even early in the season, probably due in part to delayed soaking, but apparently also to good root activity even at 30 to 36 inches, since the soil was reduced well below field capacity at that depth. As an example of such loss for the three 6-in. sections from 18 to 36 inches, soil moisture amounting to 10.0 ± 0.7, 7.5 ± 0.5, and 5.9 ± 0.5, respectively, was lost in 38 days.

Quite a different set of conditions was encountered on the Tatchera Sandy Loam site, location 4, at Nyah, in the same season. In this case the surface soil is abnormally heavy, the sticky point for the 0 to 6-in. section being 25.1 per cent., compared with 21.8 per cent. on location 3. Below 6 inches, average sticky point to 36 inches is 24.0 per cent., so that this soil is of heavier texture in the surface than below, and thus has the structural feature characteristic of Tatchera Sandy Loam developed at the surface or within a depth of 6 inches.

Soil moisture determinations showed that the first two irrigations were normal, wetting the soil to field capacity to 3 feet, but the third, fourth, and fifth irrigations were inefficient, the third failing to penetrate below 12 inches. Comparison of moisture status below 18 inches, three days after the third irrigation, with that five days after the second is illuminating. Differences in favour of the second irrigation for the three 6-in. sections from 18 inches to 36 inches were, as percentages, 10.7 ± 1.0, 10.1 ± 0.9, 7.5 ± 1.2, in spite of rainfall of 2.77 inches between the second and third irrigations. During the latter part of January the vine foliage showed signs of lack of water, and did not show adequate response to further irrigations, which followed at intervals of fifteen days. The lowest moisture content recorded for the full depth to 36 inches was 10.8 per cent. before the fourth irrigation, compared with wilting point 13.0 per cent. The ineffective character of the summer irrigations is again shown by comparing the corresponding figures for a few days after irrigation, which were 12.3, 14.6,

and 15.6 per cent., after third, fourth, and fifth irrigations, respectively, as against 21.3 per cent. after the second irrigation. For the final irrigation of the season flood watering was adopted, giving a figure of 24.6 per cent.

Penetration profile work showed that the soaking of irrigation water on this site was very patchy. Fig. 5B shows that while penetration to 30 inches was obtained after five hours' flow with a fast stream of 1 gallon in 6

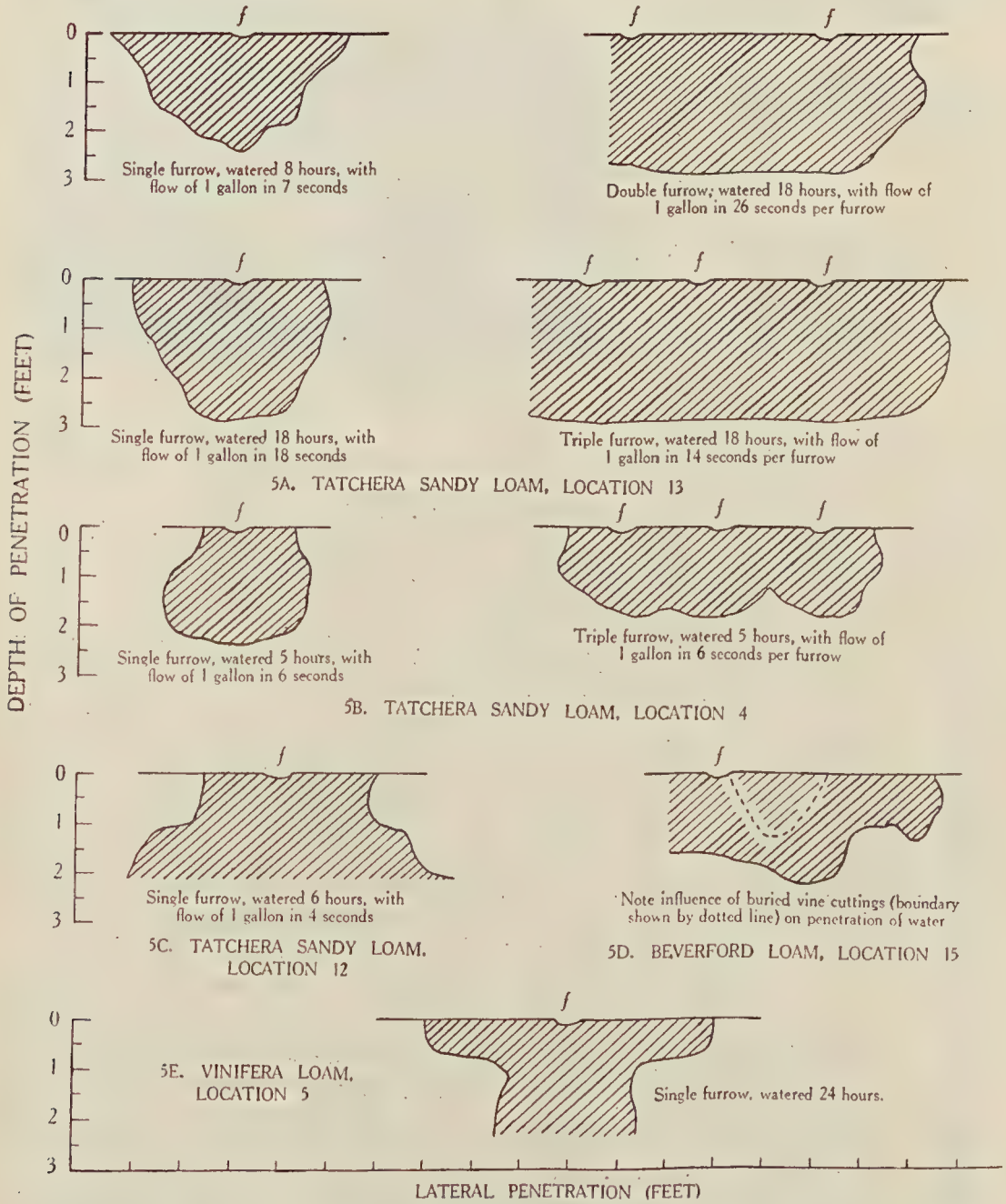

DEPTH OF PENETRATION (FEET)
0
1
2
3
f
Single furrow, watered 8 hours, with flow of 1 gallon in 7 seconds
Double furrow, watered 18 hours, with flow of 1 gallon in 26 seconds per furrow
Single furrow, watered 18 hours, with flow of 1 gallon in 18 seconds
Triple furrow, watered 18 hours, with flow of 1 gallon in 14 seconds per furrow
5A. TATCHERA SANDY LOAM, LOCATION 13
Single furrow, watered 5 hours, with flow of 1 gallon in 6 seconds
Triple furrow, watered 5 hours, with flow of 1 gallon in 6 seconds per furrow
5B. TATCHERA SANDY LOAM, LOCATION 4
Single furrow, watered 6 hours, with flow of 1 gallon in 4 seconds
5C. TATCHERA SANDY LOAM, LOCATION 12
Note influence of buried vine cuttings (boundary shown by dotted line) on penetration of water
5D. BEVERFORD LOAM, LOCATION 15
5E. VINIFERA LOAM, LOCATION 5
Single furrow, watered 24 hours.
LATERAL PENETRATION (FEET)

Fig. 5.—Showing penetration of water from furrows after irrigation. Wetted areas are hatched. f. signifies irrigation furrow.

seconds in a single furrow, a test under similar conditions on an adjoining row with three furrows gave maximum penetration to 22 inches, with minimum only 16 inches. A further test with three furrows and nine hours' watering gave minimum penetration 18 inches. At the next irrigation similar tests showed maximum penetration 36 inches, and minimum 14 inches, after ten hours' watering in three furrows. Vertical penetration is obviously very irregular, and lateral soakage is not good, seldom exceeding 2 feet in each direction from a single furrow in periods of watering up to ten hours. Examinations after three-furrow irrigation for various times suggest that the furrows should be spaced 3 feet apart, with watering up to eighteen hours. Several of the penetration profiles show to marked extent a feature noted in Fig. 5B—lateral spread restricted at and near the surface compared with that at lower depths round 12 to 18 inches. In one case of three-furrow irrigation for six hours, lateral spread at a depth of 18 inches exceeded that at the surface by 17 inches. This effect indicates that the surface soil offers greater resistance to water penetration than does the underlying subsoil.

The nature of the surface soil, the use of fast streams on short runs, together with poor furrow construction and narrow spacing of the furrows for these conditions, are indicated as causes of the patchy and generally poor penetration of irrigation water during the summer irrigations on this site. The later use of deeper furrows and smaller streams, time of irrigation being extended from ten to twenty hours, gave satisfactory results.

This location illustrates well the low loss of soil moisture in spring, maintaining an average moisture content for 0 to 36 inches of 20.5 per cent., 35 days after the first irrigation, compared with field capacity 21.1 per cent., rainfall being only 10 points in the interim. This site also showed that pronounced contribution may be made by the lower soil zones to water used by the vine—in the period 12th November, 1933, to 30th January, 1934, the moisture content (per cent.) of the 30 to 36-in. zone dropped from 22.6 $\pm$ 0.6 to 12.8 $\pm$ 0.7, compared with field capacity 22.3 and wilting point 12.5 for this section.

Test-well readings on this site are of interest in view of the under-watering which occurred at the summer irrigations. After showing a reading of 21 inches after the first irrigation, the free water level dropped at a fairly rapid rate to 4 ft. 4 in., rising to 3 ft. 6 in. after the second irrigation. Thereafter it dropped away to 6 feet, and remained at or below that depth in the periods between the third, fourth, and fifth irrigations.

At location 13, Woorinen, penetration profile studies were made at the first irrigation in the 1933-34 season, which on this site was delayed until November. This site did not show such rapid change in texture beneath the surface as some others of the Tatchera Sandy Loam type, sticky points being 21.4, 25.8, and 28.3 per cent. for the 0 to 6-in., 6 to 12-in., and 12 to 36-in. zones, respectively. Probably related to this is the fact that most of the penetration profiles on this site were of normal shape. Fig. 5A shows that, in single furrow tests, a fast stream for eight hours gave similar results to those from a medium to slow stream for eighteen hours, giving vertical penetration to approximately 30 inches, and lateral spread of about 4 feet. Double furrow irrigation for eighteen hours gave good vertical penetration of nearly 3 feet, but, with the furrows 4 feet apart, did not give sufficient lateral spread to wet between the rows. Good watering conditions were obtained by the use of three furrows, 30 inches apart, with a medium stream in each furrow for eighteen hours, giving vertical penetration to almost 3 feet, and lateral soaking almost to the vine rows. A flooded basin area on which water lay for about seventeen hours showed penetration to 38 inches.

On the Nyah site, location 12, also examined in November, 1933, vertical penetration was to at least 33 inches following six hours' run of a fast stream in a single furrow, a flooded area giving a similar result. Fig. 5C shows that lateral penetration is very good, surface wetting in the experiment just mentioned being 44 inches, while at 14 inches depth it is 57 inches, showing a sharp change similar to that mentioned above for location 4. The soil at this site showed the presence of a "hardpan," and it would appear from Fig. 5C that this feature restricted lateral penetration near the surface to some extent, but when once soaked through allowed sufficient vertical penetration to give good wetting in the more permeable zones below 12 inches. A singe furrow stream for eighteen hours gave lateral spread of water of 6 feet on the surface and 9 ft. 4 in. at 12 inches below the surface, while three-furrow irrigation for eighteen hours gave practically a full watering between the rows.

Flash Bute by Flashdale (1925)

Clydesdale STALLION and COLTS

For Sale

DEPARTMENT OF AGRICULTURE, VICTORIA

CERTIFICATED STUD BOOK CLYDESDALE STALLION and COLTS

All Sired by FLASH BUTE, C.C.S.B. 857

By Flashdale (Imp.) (20576).
by Dunure Footprint (15203 C.S.B.).
Flash Bute, Dam; Silver Bute (860 C.C.S.B.) by Baron Bute (Imp.) (15129 C.S.B.).
Grand Dam: Hiawatha Queen (C.C.S.B. 365) by Hiawatha of Australia (N.Z.S.B. 245).

1. Victoria Double Flash (Stallion)

Bright bay, foaled 24th October, 1932.
Sire: Flash Bute.
Dam: Victoria Lovelight (C.C.S.B. 2233) by Flashdale (Imp.) (C.S.B. 20576).
Grand Dam: Victoria Lovely (1604 C.C.S.B.) by Baron Wigton (Imp.) (13884).
This horse shows very good quality, and is a splendid mover.

2. Victoria Pasha

Dark bay, foaled 9th September, 1933
Sire: Flash Bute.
Dam: Victoria Patti (C.C.S.B. 1611) by Baron Wigton (Imp.) (C.S.B. 13884).
Grand Dam: Patricia (C.C.S.B. 714) by Baron Bold (A.C.S.B. 27).
A reachy colt with splendid conformation.

3. Victoria Lascar

Blue roan, foaled 3rd November, 1933.
Sire: Flash Bute.
Dam: Vic. Luscious (C.C.S.B. 1607) by Baron Wigton (Imp.) (13884 C.S.B.).
Grand Dam: Lucilla (C.C.S.B. 554) by Baron Bold (A.C.S.B. 27).
A heavy boned, weighty colt.

4. Three-year-old Colt

Sire: Flash Bute.
Dam: Duchess of York (C.C.S.B. 2230).
Grand Dam: Royalty (836 C.C.S.B.) by Baron Wigton (13884 C.S.B.).

All the above colts are available at prices to suit the farmer

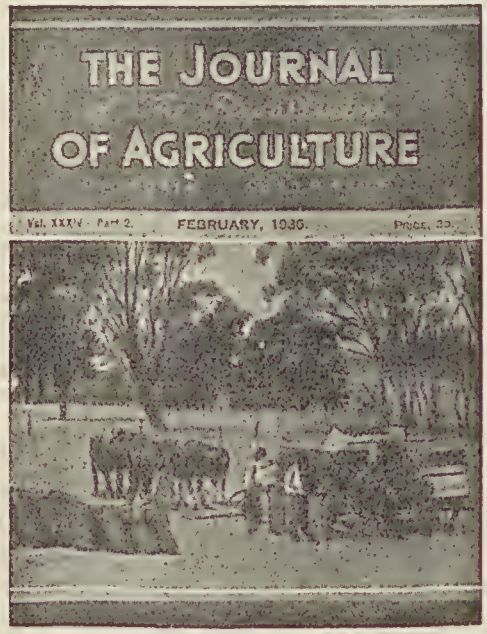
For further Particulars apply to—

The Manager, State Research Farm, Werribee

The Journal of Agriculture

OFFERS EXCEPTIONAL ADVANTAGES

for ADVERTISING



THE JOURNAL OF AGRICULTURE circulates widely throughout the country districts of Victoria and amongst farmers of the Commonwealth, reaching also country bankers, professional and business men, school teachers, &c. It offers exceptional advantages for the advertising of all goods required by the farmer and in the rural home

Only advertisements approved by the Department are accepted for publication in the *Journal*

The *Journal of Agriculture*—the Official Journal of the Department of Agriculture of Victoria—is published monthly and has a GUARANTEED CIRCULATION of

10,000 COPIES MONTHLY

Advertising Rates on Application to the Director, Dept. of Agriculture, Melb., C.2

Several examples of Tatchera Sandy Loam have been treated above because it is the most important of the soil types under vines in the Swan Hill district, and is the main linkage type between many of the settlements of that area. It is evident that considerable variations exist within this type with regard to reaction to irrigation water, but a fairly general feature is a tendency toward impeded penetration of water.

Vinifera Loam.

Work on this soil type was restricted to the one site at Nyah, and the season 1933-34. Considering the full depth of sampling, 0 to 36 inches, field capacity 22.6 per cent., this soil attained average soil moisture content of 25.3 per cent. after the second irrigation, this excess being due in part to heavy rain, and 24.1 per cent. following flood irrigation at the final watering for the season. The more important summer waterings, however, were not completely satisfactory, corresponding figures being 20.0 and 19.4 per cent., after the third and fourth irrigations respectively. However, vine growth was satisfactory throughout the season.

At the fourth irrigation (end of January), there was evidence of poor penetration of water, no significant increases in soil moisture content being found below 18 inches, although penetration profiles taken on adjoining rows indicated penetration to depths approximating 30 inches. These results suggest patchy penetration, similar to that which occurred on the Tatchera Sandy Loam location 4. Fig. 5E shows that lateral soakage on the surface of this soil is very good, but there is pronounced delayed penetration caused by the heavier horizon at about 9 inches, so that surface wetting gives very poor indication of the lateral extent of subsoil soakage. A test with two furrows spaced 4 ft. 6 in. apart, watered for 24 hours, practically covered between the rows laterally at the surface, but because of the effect mentioned above, it is evident that multi-furrow or flood irrigation is called for on this soil.

This site showed rapid drying out after irrigation, particularly in the light surface soil, where moisture contents as low as 3.3 per cent. were recorded even early in the season. There was good utilization of moisture at lower depths by the vine, losses in 32 days during December and January being 12.6 $\pm$ 0.7, 10.9 $\pm$ 0.7, and 7.3 $\pm$ 0.7, respectively, for the three 6-in. sections from 18 to 36 inches. The soil was reduced to moisture content 13.0 per cent. for 0 to 36 inches before the third irrigation, compared with wilting point 12.8 per cent.

Test-well records on this site showed that at no time was free water noted above 3 feet, levels fluctuating between this depth and 5 ft. 6 in. over the season, rising to the higher level after irrigation.

Nyah Clay Loam.

Fig. 6A sets out soil moisture conditions on location 7 on this soil type in the season 1932-33. The figure shows that up to December, moisture losses after irrigation are of similar order in the three zones to 18 inches, and much smaller below that depth, although significant to 30 inches. During January there is considerably increased and significant loss at all depths, although moisture in the 30 to 36 in. zone never approaches a low figure. Significant increase in moisture content down to 36 inches is shown following irrigation, indicating effective watering.

Compared with field capacity, 24.5 per cent., and wilting point 15.4 per cent., the 0 to 36-in. means for moisture content on this site fluctuated between 25.1 per cent. following irrigation, and 17.5 per cent. before watering, so that soil moisture conditions on this site were satisfactory in general, and the normal summer inter-irrigation period of four weeks is suitable for this type of soil. It is noted, however, that these results were obtained under conditions of vine vigour somewhat less than normal.

In the season 1933-34 a poorly drained site, location 6, on Nyah clay loam was examined. Test-well readings throughout the season fluctuated between 1 ft. 9 in. and 3 ft. 3 in., showing the usual elevation after irrigation. In soil moisture properties this soil is very close to that on location 7 just described. Soil moisture results varied over a restricted range during the season, vines on the site being in poor condition. For 0 to 36 inches, values a few days after irrigation were fairly uniformly around 25.0 per cent., while those just prior to irrigation were of the order 21.6 per cent. There was little fluctuation in moisture content below 18 inches, the range for the season for the soil below this depth to 3 feet being 22.1 to 27.1 per cent.

Woorinen Loam.

Soil moisture fluctuations throughout the 1932-33 season, on location 9, on Woorinen Loam, are shown in Fig. 6c. Moisture losses during November were remarkably small, except in the surface zones, there being no significant loss below 12 inches until December. During December, losses down to 24 inches became significant, while in the height of summer significant loss to 30 inches occurred, the total losses at this time being markedly greater than in November. Rapid drying of the upper zones and restriction of loss to 30 inches suggests relatively shallow root establishment in this type, which is to be expected from its general character.

Penetration profile work on this site in the 1933-34 season showed delayed penetration effects—penetration from a small stream running in a single furrow for fourteen hours was to approximately 2 feet, with surface lateral spread of 5 ft. 3 in., restricted to 4 ft. 3 in. at 6 inches below the surface. Double-furrow irrigation for fourteen hours soaked across from row to row, and penetrated to at least 2 ft. 6 in. deep between furrows. This block has been subjected to good green manuring practice, and opening up of subsoil to improve permeability, and the results of these tests indicate the favorable effects of this treatment. Vine growth, although a little lacking in vigour, was of reasonably normal character for this type of soil.

Considering the upper 3 feet of soil, a typical moisture content a few days after irrigation is 25.2 per cent., and immediately prior to irrigation 21.3 per cent., compared with field capacity 25.2 per cent., and wilting point 17.2 per cent.

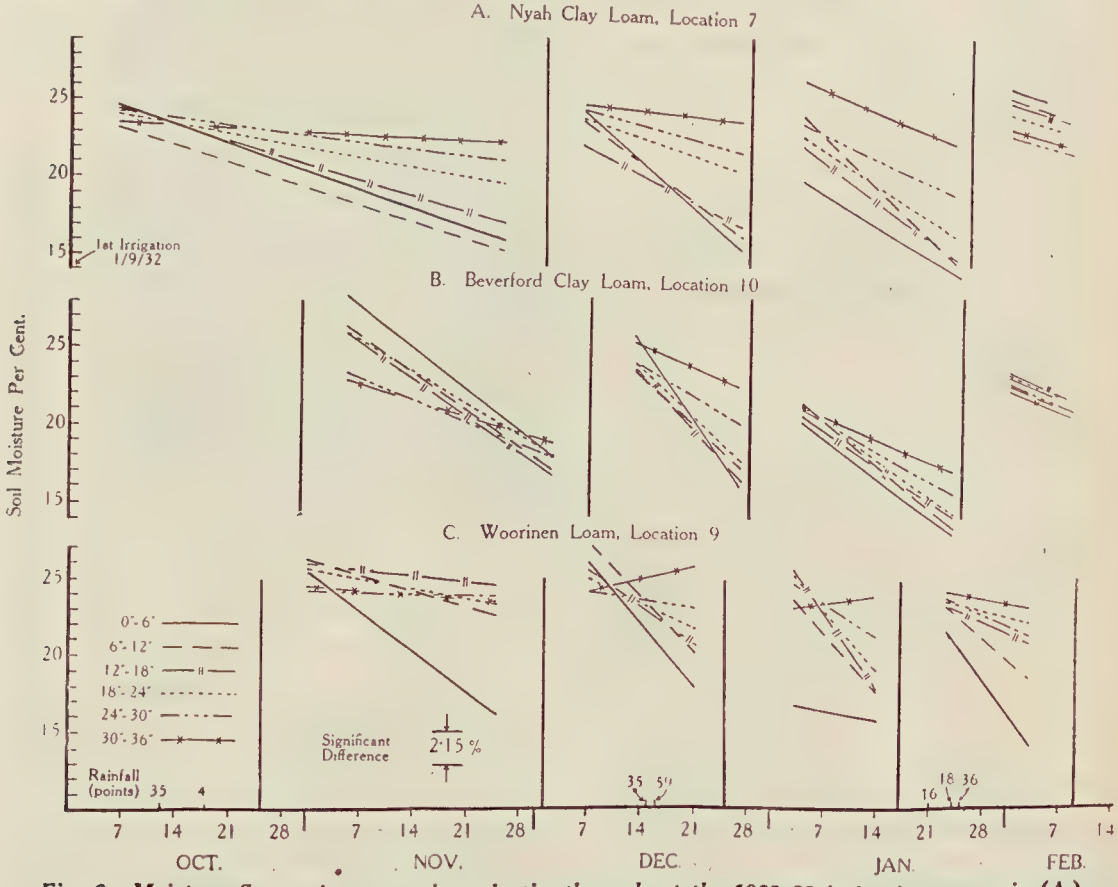


Fig. 6.—Moisture fluctuations at various depths throughout the 1932-33 irrigation season in (A.) Nyah Clay Loam; (B.) Beverford Clay Loam and (C.) Woorinen Loam. Vertical lines show dates of irrigation.

Another Woorinen site, location 8, was examined in 1933-34. Soil moistures for 0 to 36 inches ranged between 21.8 and 25.1 per cent. soon after irrigation, and down to 14.0 per cent. before irrigation, compared with field capacity 24.7 per cent., and wilting point 16.5 per cent. Similarly to location 9 in the previous season, there was but little variation in the 30 to 36-in. zone, the range being 24.2 to 26.3 per cent., except for the figure 20.9 per cent. recorded in March, when the vines were very dry and leaves falling.

Test-well records showed that there was a fairly rapid fall of soil water, at the rate of about 2.8 inches per day, after temporary perching at levels as close to the surface as 6 inches. There was evidence of over-watering at early irrigations, which took up to 72 hours to complete. Summer irrigations were reduced to 24, and even to 12 hours, and were found to be efficient, significant gains in moisture content to 30 inches following irrigation.

Penetration profiles on this site showed similar results to those on location 9, delayed penetration through the subsoil being indicated by lateral spread of 5 ft. 6 in. on the surface from a single-furrow irrigation with a fast stream for twelve hours, while lateral spread 12 inches below the surface was restricted to 4 ft. 3 in. Vertical penetration was to at least 27 inches. Double furrows spaced 4 feet apart, with fast streams for twelve hours, wetted the surface soil between rows, and penetrated to at least 3 feet vertically between the furrows, but because of the impeded penetration into the clay horizon, vertical penetration 2 ft. 6 in. outside the furrows was to 14 inches only. After 24 hours' watering under similar conditions, vertical penetration to 28 inches beneath the furrows, and to 26 inches between them was found, some free water showing on the surface twenty hours after watering ceased, so that the surface soil remained sloppy for a considerable period, due to slow penetration.

Indications are that losses of soil moisture from Woorinen Loam are rapid in the summer, and that vines are not as deeply rooted as on certain other soils. Woorinen Loam is therefore unable to go longer than four weeks between irrigations during summer without entailing risk of damage to the vines, unless notable rainfall modifies the situation.

Beverford Clay Loam.

Conditions for a site, location 10, on Beverford Clay Loam from the soil moisture aspect, in the season 1932-33, are shown in Fig. 6B. The important features are the rapid rate of loss of soil moisture, which exceeds that on other locations, in the earlier parts of the season at least, and the significant losses from the lower depths, that from the 30 to 36-in. zone being significant even in November. The figure indicates that the third irrigation was not fully effective, no significant increase in soil moisture being recorded below 24 inches. Apart from this occasion, it is evident that water penetration was excellent to 36 inches.

Considering 0 to 36-in. means, a typical soil moisture content after irrigation is 22.6 per cent., compared with field capacity 23.9 per cent., while just prior to irrigations, figures of 17.5, 18.1, and 14.3 per cent. were recorded, compared with wilting point 18.0 per cent. The second irrigation provided a good test of the length of time that this soil can go without water, because the soil dried from 24.2 per cent. six days after the irrigation, which was therefore a good watering as shown by comparison with the field capacity, to 17.5 per cent. twenty days after the irrigation. This makes evident the rapid rate of drying on this soil, and indicates that this land cannot go without water much longer than three weeks in summer, although relatively few cases have been observed in which vines have obviously suffered.

General confirmation of these findings was obtained in 1933-34 on a different site, location 11. Significant losses of soil moisture from all depths down to 36 inches even in early summer were again in evidence, and also drying of the soil from 28.0 per cent. in the region of field capacity (27.3 per cent.) to the value 19.0 per cent. near wilting point (19.8 per cent.) in three weeks in January. Good penetration of irrigation water was again found, typical gains in moisture content as the result of irrigation in the three 6-in. zones from 18 to 36 inches, being 9.0 ± 0.8, 5.1 ± 1.1, and 4.6 ± 0.5 per cent. Although irrigations were efficient in general, this soil was frequently below wilting point, as shown by soil moisture tests and evidenced by the vines. In addition to the case already noted, soil moisture values of 17.0 per cent. 29 days after the second irrigation, and 18.1 per cent. 55 days after the fourth, at the end of the season, were recorded for the 0 to 36-in. depth. Test-well records on this site showed only one reading above 3 ft. —free water levels were usually at approximately 3 ft. 6 in. after irrigation, showing

reasonably rapid fall to about 5 feet between irrigations (Fig. 4B).

In general, Beverford Clay Loam appears to lose soil moisture more rapidly than other types, showing greater utilization of moisture from depths below 24 inches, and dries rapidly towards wilting point, making an inter-irrigation period of three weeks in summer the maximum that could be recommended with safety.

Beverford Loam.

A characteristic of this soil type, as shown by the soil survey(1) is the passing from sandy loam or loam texture to that of medium clay at a depth of about 9 inches. Penetration profiles on location 15 in the summer of early 1934 showed rapid lateral penetration through the light surface soil, apparently due partly to delayed penetration through the heavier soil at approximately 1 foot depth (Fig. 5D). It will be noted that the point of maximum penetration is displaced markedly from beneath the furrow, this being attributed to accumulation of water in, and subsequent soakage from, the disturbed soil of a trench carrying buried vine cuttings in the position indicated. Apart from this effect, penetration after twenty hours' irrigation in this test was only to approximately 21 inches. A two furrow test on an adjacent row for the same time of irrigation showed penetration to at least 30 inches.

On a further site, location 14, on this soil type during the same period, good lateral soakage was again in evidence, and need for attention to vertical penetration was also indicated. A moderate stream in a single furrow for 24 hours gave lateral spread of about 6 ft. 6 in., but vertical soakage was only to about 18 inches. A faster stream in a single furrow for twelve hours gave corresponding figures of 8 feet and 27 inches respectively. Double furrows spaced 4 ft. 6 in. apart gave vertical penetration to 23 inches below the furrows and to 20 inches between them after ten hours' watering, this being increased to approximately 30 inches for twelve hours' watering, while 24-hour streams wet to at least 30 inches and gave lateral soakage to within a foot from the vines.

It would therefore appear that irrigation times approaching 24 hours are necessary on this type of land to ensure effective vertical penetration of water, and although lateral soakage is good it is likely that three furrows would be the most efficient system.

Bungunyah Clay.

This soil is of heavy texture throughout the profile, and the difficulty is to obtain water penetration. Tests carried out early in 1934 showed lateral spread of 4 ft. 6 in., and vertical penetration to 12 inches after irrigation for twelve hours in a single furrow, while eighteen hours' watering under similar conditions gave corresponding figures of 5 feet and 18 inches, both tests showing maximum penetration under the furrows and a tendency to delayed penetration at the heavier clay of the subsoil at depths of about 6 to 9 inches. Double furrows spaced 5 feet apart and watered for eighteen hours gave lateral spread on the surface of 10 feet, soil being wet beneath the furrows to 24 inches, and between the furrows to 16 inches. A flooded basin, given a watering of approximately 3 inches, was wet to an 18-in. depth of soil when examined eighteen hours after application of the water.

Koraleigh Sandy Loam.

This type of soil, with sandy loam overlying sand, provides marked contrast with Bungunyah Clay, both types occurring at the one settlement of Bungunyah. Penetration profiles showed remarkable freedom in vertical penetration, but lateral spread naturally was not pronounced. Single-furrow tests for waterings of 2, 3¼, and 8 hours gave lateral spreads of 4 ft. 6 in., 3 ft. 5 in., and 4 ft. 9 in., respectively. Double furrows spaced 4 ft. 6 in. apart showed a dry zone little more than a foot wide between the furrows after two hours' watering, but watering for eight hours wetted between the furrows, and also between rows, except for a small dry cap beneath the trellis.

Soil Moisture Fluctuation.

To show the general trend in soil moisture fluctuation in the district as a whole, means of four sites for the upper 3 feet of soil in the 1932-33 season are given in Fig. 7. Locations which contributed to these means are number 3, Tatchera Sandy Loam; number 9, Woorinen Loam; number 10, Beverford Clay Loam; and number 7, Nyah Clay Loam. The figure shows that means for soil moisture soon after the various irrigations all differ significantly between themselves, as also do those just prior to irrigation, while between the two sets of values there is naturally wide difference. The increasing difficulty of maintaining high soil moisture levels as the season progresses is evident from the figure, and the extensive demand on

soil moisture in the height of summer in January, after the third irrigation is obvious from the low general level to which moisture in these soils was reduced before the fourth watering. The contrast between this and the two preceding irrigations is well shown, emphasizing the much lower soil moisture demand in late spring and early summer as compared with the main summer period.

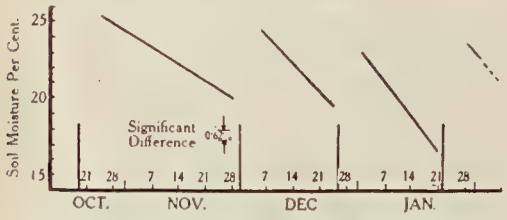


Fig. 7.—Average soil moisture fluctuations 0 to 36 inches for the Nyah-Woorinen district in the 1932-33 irrigation season. Vertical lines indicate dates of irrigation.

Comparison of the individual means for the four sites which contribute to Fig. 7 is of interest at this stage, chiefly to bring out the fact that Beverford Clay Loam suffers unusually rapid moisture losses as compared with the general trend. Fig. 8 shows that when, as after the first and second waterings, the four soils begin the inter-irrigation period at similar moisture status, rate of loss of moisture from Beverford Clay Loam materially exceeds that from the other types, particularly after the first irrigation. The figure illustrates also the lower rate of loss of moisture from Woorinen Loam than that from the other soil types.

The chief fact as regards soil moisture fluctuation shown in 1932-33, namely the greatly increased water requirement in January and February, as compared with the earlier part of the season, was confirmed in the following season, as described above in consideration of individual soil types. Obviously this is of considerable importance in the planning of the irrigation schedule.

Vine Requirements and Soil Properties.

Irrigation in relation to vine requirements and soil properties is approached from two aspects, firstly, with regard to the requirements of individual soil types, and secondly, with respect to the planning of the irrigation schedule for the community.

The ideal irrigation is such that the soil is wetted throughout the zone of root penetration without exceeding field capacity. It is obvious that many of the irrigations studied in the course of this work have departed in some way from this standard. At the same time, examples have been provided of efficient irrigation as judged by wetting throughout the root zone without appreciable elevation of water table. Consideration of the moisture properties of the various soil types, together with the other data available, such as periodic determinations of soil moisture content, penetration profile, and test-well studies, has led to certain broad recommendations for the irrigation of the major soil types.

This summation of the experience gained in the present work is set out in Table III. The table applies only to normal summer irrigations, and is based on three-furrow irrigation,

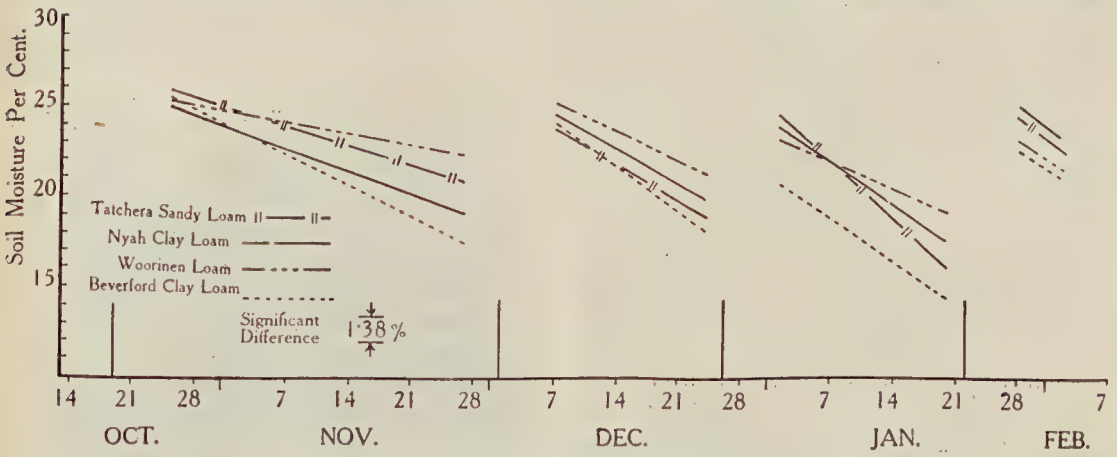


Fig. 8.—Moisture fluctuations 0 to 36 inches of four soil types during the 1932-33 irrigation season. Vertical lines indicate dates of irrigations.

TABLE III.—SUMMER IRRIGATION OF INDIVIDUAL SOIL TYPES.

Soil Type.	Stream in Each of Three Furrows.	Duration of Irrigation.	Quantity of Water Applied.
		(Hours).	(Inches).
Tatchera Sand	Fast (1 gallon in 6 to 7 seconds)	6 to 8	3½
Tatchera Sandy Loam	Medium (1 gallon in 10 seconds)	12	4
Vinifera Loam ..	Medium to slow (1 gallon 14 to 17 seconds)	16 to 20	4
Nyah Clay Loam	Medium to slow (1 gallon 14 to 17 seconds)	16 to 20	4
Woorinen Loam	Medium (1 gallon in 10 to 14 seconds)	12 to 16	4
Beverford Clay Loam	Medium (1 gallon in 10 to 12 seconds)	12 to 16	4

and 8-chain runs, as most of the investigatory work was done under conditions of this kind. The three-furrow system was found generally suitable, although two furrows gave satisfactory results on certain soils, such as Beverford Clay Loam. As far as length of run is concerned, a more general adoption of 6 chains would be to the advantage of the district, particularly in the effort to control over-watering in the headlands, usually of lighter soil than elsewhere. A summer inter-irrigation period of little more than three weeks for Woorinen and four weeks for Nyah has been envisaged in construction of the table, so that it is implied that the soils do not become excessively dry prior to irrigation.

Naturally it is recognized that each vigneron has irrigation problems more or less peculiar to his particular holding, involving consideration of gradient, length of run, head of water available, mixed soil occurrences, and other factors, which, with the actual nature of the soil, influence the size of stream that can be used and therefore the duration of the watering, so that any recommendations must be regarded as general guides only. During the progress of this work considerable improvement in irrigation practice has occurred in the district, with respect to adjustment of areas irrigated to the water available, control of streams with efficient outlets, spacing and construction of furrows, and especially quantity of water applied and duration of irrigation. A typical case is that of a holding on Beverford Loam, formerly given 30 hours' irrigation, which has been reduced to twelve to eighteen hours with general benefit. Surface pools, following prolonged and heavy watering, and due in part to faulty grading, have been reduced. Certain of the sites investigated were fitted as demonstration units, with measuring wheels for irrigation water, and concreted head ditches with adjustable outlets. Stream sizes are quoted (Table III.) in times required for a flow of one gallon, as this is a system easy for the blockholder to check. Demonstrations of measured streams have been given at field days organized by the Nyah-Woorinen Enquiry Committee.

With regard to the community irrigation schedule, the spacing of summer waterings at intervals of about four weeks, as was the usual practice during this work, is generally satisfactory, except for the influence of Beverford Clay Loam, and probably of Beverford Loam also, on the situation at Woorinen. It has been shown that Beverford Clay Loam requires watering at intervals of approximately three weeks during summer. On this account inter-irrigation periods at Woorinen should be as little as practicable beyond three weeks, or Beverford Clay Loam should be given preferential or supplementary treatment on the roster. Because of the gravitational supply, prospects of obtaining such frequent summer watering at Woorinen may be better than elsewhere. The present work has not shown any particular reason for suggesting departure from the four-weekly summer interval at Nyah.

A question of considerable importance is that of spring watering, which for the present purpose may be taken to include late winter, spring, and early summer irrigations. It has been shown that there is a general tendency to maintain soil moisture supplies at values considerably in excess of the requirements of the vines during this period. More satisfactory conditions might be expected to follow attention to the possibility of delaying the first irrigation for the season, to reducing the application of water, and to increasing the period between irrigations during the early season up till mid-December, when soil moisture losses become more rapid.

Although rainfall has been mentioned only incidentally throughout this report, its incidence may have notable influence on the spacing of irrigations in this district. In seasons when the late winter is dry the situation is clear, but when rain has fallen to any considerable extent there is usually a doubt as to the best time for starting the irrigation season. The soil moisture work has provided a background against which may be judged the importance of special weather effects, as a considerable number of sites, whose moisture

behaviour is known, are available for sampling at any particular time to give a guide for district practice. After beginning the season's watering on a sound basis, not only may the spacing of irrigations be much wider than in summer, but if good penetration of the subsoil has resulted from winter rainfall and/or the first irrigation, the amount of water at later irrigations to mid-December may be cut down in most cases to about 2½ inches.

Free Water in the Soils.

The previous section has dealt with the irrigation requirements of the vines on different soil types, and methods of meeting these demands. Knowledge of the occurrence of free water in the soils of the district gives an indication of the extent of water application in excess of these requirements.

As shown by test-well records, the general position in the district during this work was that elevated water tables persisted for the bulk of the irrigation season, rising at each irrigation, and then falling comparatively slowly, especially in spring. In most cases free water level had receded to 6 feet or below by May, and remained at depth during the winter when there was no irrigation. It is evident, therefore, that in general, water application was excessive during the irrigation season. With slow penetration of water through the subsoils and with heavy spring watering, such a condition was engendered that it was difficult to avoid high water table for the rest of the season and still replenish losses of moisture from the upper soil zones. Nearly all test-well readings were high in the spring, and analysis of the soil moisture data also suggests over-watering at that time, with slow drainage from the lower root zones.

Delving a deep trench prior to the burial of vine cuttings.

This "delayed penetration" of irrigation water in many soils of the district is regarded as the factor dominating the horticultural position from the soil aspect. It has been shown that certain soil types have profile structure tending to restrict water movement through the subsoil, so that rate of soakage of water into the surface soil gives little indication of its rate of movement in the lower zones. The operation of this slow water penetration, however, is evident to the blockholder in many cases in the length of time that may be required after irrigation before the land is fit for cultivation; intervals of ten days are not uncommon at Woorinen.

The inhibiting effect on root function of excessive soil water in the root zone and its influence in delaying maturation are well known, as well as the possibility in land of this kind of causing concentration of injurious salts within the root area. The viticultural investigation in this district has shown that there is a lag of approximately ten days in maturation between the Nyah-Woorinen and the Mildura districts. It is considered that part of this effect may be attributed to the soil-water situation described, with its associated and inseparable influence on soil aeration.

The position as regards free soil water at shallow depth was serious from the community standpoint at the time of the work described above. In addition to the test-well records concerned in this investigation, a survey by boring for free water in certain areas of unthrifty vines was carried out in 1933 by Mr. L. J. Norton, a local officer of the State Rivers and Water Supply Commission. This survey revealed that a considerable number of localized areas showed free water within 4 feet of the surface, especially in the lighter soils on the upper sections of irrigation runs. As further progress was made with test-well records in the present investigation, it became evident that in several of the soils examined, the aggregate of the periods during which free water was within reach of the vine root zone represented a considerable portion of the total irrigation season. This gave full confirmation to the idea of delayed penetration in many of these soils, a concept which had followed from the earlier knowledge of soil-water relationships in this district.

A situation of this kind called for both individual and community action. Notable improvement in soil condition and vine growth

A trench ready for the burial of cuttings.

followed demonstration of the presence of high water table in unthrifty areas on certain holdings, and subsequent close attention to watering. Nevertheless, much scope for improvement remains. It is obvious that a special problem in the district, compared with certain other vine-growing settlements, such as Mildura, is the sluggish movement of the water through the subsoil. On this account it is specially important to ensure that irrigation applications are reduced to the minimum necessary to meet requirements of soil and vine, especially in the early parts of the season, when use of water by the vine is slight, and when rate of fall of free water table is less rapid than in summer. In addition, there is call for full exploitation of practices designed to increase the permeability of impeding soil horizons, and for provision of drainage in cases which do not show adequate response to such practices combined with controlled irrigation.

Opening up of the subsoil by the use of green manuring, gypsum, and burial of cuttings in delved trenches, has given some excellent demonstrations of beneficial effect in this district. These practices are being adopted more widely, and detailed investigation of their effect is in hand on the Committee's experimental block at Woorinen.

With regard to drainage, the view is taken that if a high water table persists over a considerable portion of the irrigation season, even though it fluctuates considerably as the result of irrigation, need for drainage is just as urgent as in cases where the water is held at some definite zone in the profile over the whole season. This led to the conclusion that installation of drainage may be warranted in certain cases in which unsatisfactory soil-water conditions continue after adjustment of irrigation applications and attempted sub-soil amelioration. It is recognized, however, that, as this situation is dependent on poor permeability of the sub-soil, drainage may require such intensive distribution as to render its provision uneconomic.

Since 1934, the trend of soil investigation has been towards the drainage aspect. The State Rivers and Water Supply Commission has had under inquiry the question of modification of the community drainage structures, while the Closer Settlement Commission has made detailed examination of a considerable number of holdings in the district on which it had been suggested that there was need for drainage. Drains have been installed in a number of cases, and opportunity has been taken of following the influence of drainage by means of test wells in typical drained areas, while the general situation in the district with respect to free soil water has been examined further by means of long traverses of test wells across the settlements. The Council for Scientific and Industrial Research has been responsible for soil investigation work in these later phases.

References.

1. Taylor, J. K., and Penman, F.—A Soil Survey of the Woorinen Settlement, Swan Hill Irrigation District, Victoria. C.S.I.R., Bul. 45, 1930.
2. Taylor, J. K., Penman, F., Marshall, T. J., and Leeper, G. W.—A Soil Survey of the Nyah, Tresco, Tresco West, Kangaroo Lake (Vic.), and Goodnight (N.S.W.) Settlements. C.S.I.R., Bul. 73, 1933.
3. Marshall, T. J, and Penman, F—A Soil Survey of part of the Murrabit Irrigation Settlement (Vic.), and of the Bungunyah Irrigation Settlement (N.S.W.). Journ. C.S.I.R., 1932, 215.
4. Walters, D. V.—Unpublished data
5. Fisher, R. A.—Statistical Methods for Research Workers. 5th Edition.

Smoke . . .

"LUCKY HIT" TOBACCO

Plug and Cut

A BLEND CONTAINING CHOICE SELECTED AUSTRALIAN GROWN LEAF

The British-Australasian Tobacco Co. Pty. Ltd.

POULTRY FOR SETTLERS

WHITE LEGHORNS and AUSTRALORPS

For prices and particulars apply to
THE MANAGER,
RESEARCH FARM,
WERRIBEE.

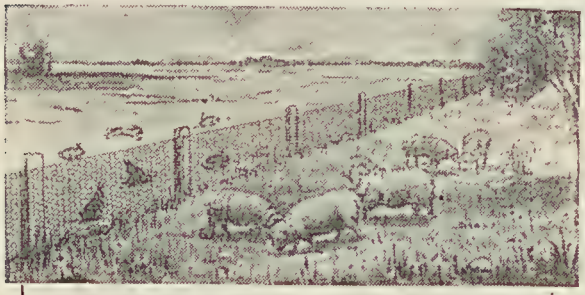
YOU GET THE BEST BY USING THE BEST

COCKBILL'S

BLOOD & BONE
BLOOD, BONE, & SUPER.
MEAT MEAL
BONE MEAL
BONE GRIT
NEATSFOOT OIL

J. COCKBILL

407 POST OFFICE PLACE, MELBOURNE, C.1
TELEPHONES—CENTRAL 2097, 2098



LYSAGHT'S

100% Australian Made 100%

Fencing and Other Wires, Wire Netting, Zinc Oxide.

Our Netting and Other Products are known through the Commonwealth as of the highest standard. Obtainable from all leading Merchants and Storekeepers.

Look for Our Marker in Every Roll of Netting.

Manufactured by

Lysaght Bros. & Co. Ltd.

Head Office: 17-19 Bridge Street, Sydney
Works: Parramatta River

Agents for Victoria: Gibbs, Bright & Co., 34 Queen Street, Melbourne

Now Available

Price 1/9 *(including postage)*

A NEW EDITION of "Beekeeping in Victoria," a comprehensive book in which beekeeping practices are fully described, has been published by the Department of Agriculture.

This publication, which contains 165 pages, is well illustrated, and should be of interest not only to commercial apiarists, but also to those who desire to carry on bee culture as a hobby or side-line to other occupations.

Obtainable from

The Director,
Department of Agriculture,
Melbourne, C.2

THE VICTORIA HERD

of Red Poll Cattle

Maintained for Milk and Beef at the State Research Farm, Werribee.

BULL CALVES

Six For Sale at Reduced Prices

No. 1. VICTORIA DONALD. (AA, C.R.). Born 16th March, 1935 *Price* 40 guineas
Sire : Woodburn Peter Pan (Imp. in utero) (1504 AA). *Dam :* Victoria Rose Major (5AA). f.o.r. Werribee.
Victoria Rose Major produced 455 lb. butter-fat in 273 days, and 531 lb. in 365 days. (An AA Bull).

No. 2. VICTORIA VALHALLA. (A, C.R.). Born 14th December, 1935 .. *Price* 20 guineas
Sire : Chandpara Valentine (762 AA). *Dam :* Victoria Asphodel (3008 A). f.o.r. Werribee
Victoria Asphodel produced 322 lb. butter-fat as Jr. 4 (273 days).

No. 3. VICTORIA ST. PETER. (A, C.R.). Born 29th July, 1936 .. *Price* 15 guineas
Sire : Woodburn Peter Pan (Imp. in utero) (1504 AA). *Dam :* Victoria Kosher (3914 A). f.o.r. Werribee
Victoria Kosher produced 286 lb. butter-fat in 273 days as Sr. 3.

No. 4. VICTORIA DUTCHMAN. (A, C.R.). Born 19th November, 1936 *Price* 10 guineas
Sire : Woodburn Peter Pan (Imp. in utero) (1504 AA). *Dam :* Victoria Friesia (5060 B) f.o.r. Werribee
Victoria Friesia produced 264 lb. butter-fat in 273 days as Jr. 2.

No. 5. VICTORIA BLUE PETER. (A, C.R.). Born 12th February, 1937 *Price* 11 guineas
Sire : Woodburn Peter Pan (Imp. in utero) (1504 AA). *Dam :* Victoria Blue Eye (4883 A). f.o.r. Werribee
Victoria Blue Eye produced 308 lb. butter-fat in 273 days as Jr. 2.

No. 6. VICTORIA EROS. (A, C.R.). Born 7th April, 1937 .. *Price* 11 guineas
Sire : Chandpara Valentine (762 AA). *Dam :* Victoria Flirt (3906 A). f.o.r. Werribee
Victoria Flirt produced 369 lb. butter-fat in 273 days as Jr. 4.

Prices are based on the average butter-fat production of the dam in 273 days, except in the case of progeny of heifers without completed test, the price then being 10 guineas.

An amount of 2 guineas per quarter maintenance has been added to calves 3 months old and over.

Inspection cordially invited. For further particulars apply to—

THE DIRECTOR OF AGRICULTURE, MELBOURNE, C.2; OR THE MANAGER, STATE RESEARCH FARM, WERRIBEE

DEPARTMENT OF AGRICULTURE, VICTORIA

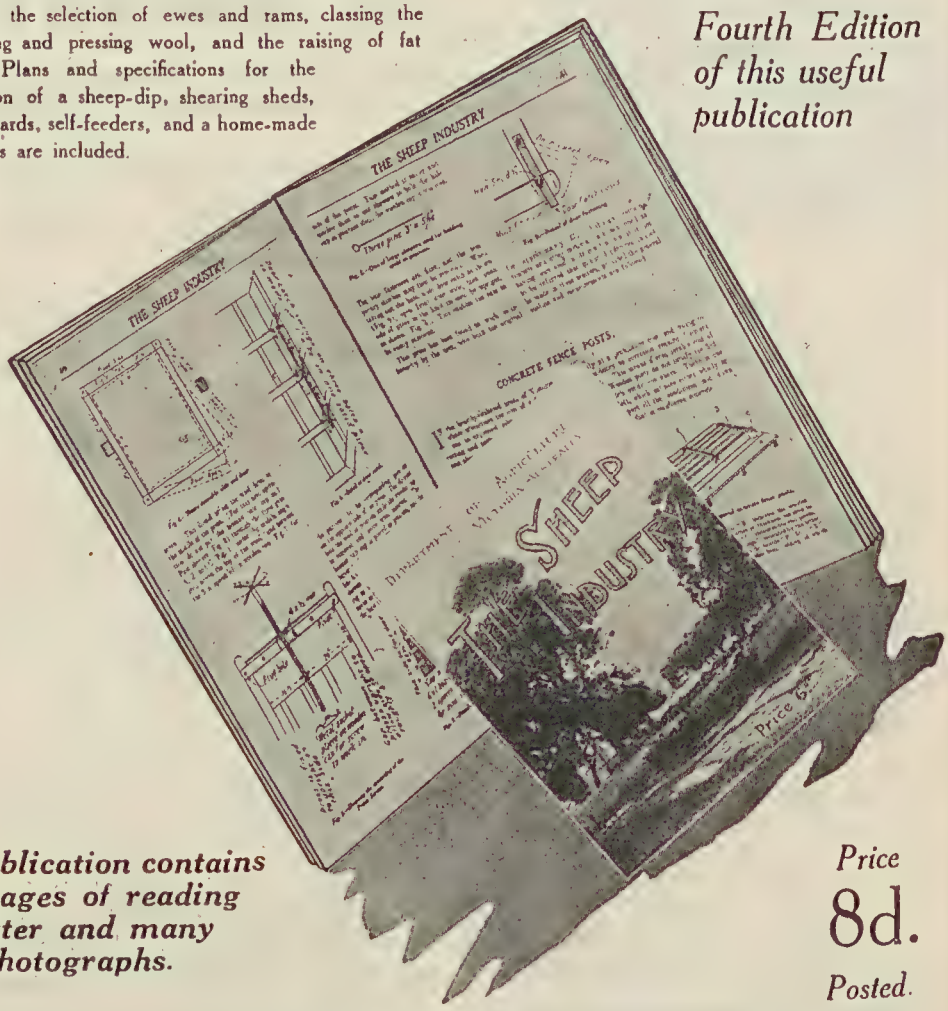
THE SHEEP INDUSTRY

A profusely illustrated publication dealing with Sheep-raising, also Sheep Diseases and their treatment.

NOW AVAILABLE

A . . Fourth Edition of this useful publication

METHODS of countering the attack of the sheep blowfly are outlined in detail. Other chapters deal with the selection of ewes and rams, classing the clip, baling and pressing wool, and the raising of fat lambs. Plans and specifications for the construction of a sheep-dip, shearing sheds, drafting yards, self-feeders, and a home-made wool press are included.



The publication contains 104 pages of reading matter and many photographs.

Price 8d. *Posted.*

Obtainable from the DIRECTOR, Department of Agriculture, Melbourne, C.2.

How Rail Fares have come DOWN!

Never before have the return fares for travel from "Anywhere to Anywhere" on the Victorian Railways system (suburban journeys excepted) been so attractive.

The striking reductions made are revealed in the following comparison for a journey of, say, 100 miles :—

MONTH-RETURN FARES

Previous		PREVAILING	
1st Class	2nd Class	1st Class	2nd Class
39/8	**26/6**	**22/1**	**17/8**

Day-Return Tickets (where the train service permits a day-return journey being made) issued for a journey of 100 miles are EVEN CHEAPER than the prevailing month-return fares—

1st Class, **16/7** - 2nd Class, **13/3**

REMEMBER! YOU SAVE MONEY WHEN YOU TRAVEL BY RAIL

For further details of fares, consult any Stationmaster, or the Victorian Government Tourist Bureau, Queen's Walk, Melbourne (Branch Office, Spencer Street Station). Tel. Central 2042.

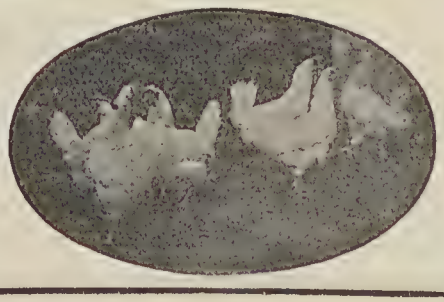
DEPARTMENT OF AGRICULTURE

White Leghorn and Australorp Eggs . .

FOR SETTING

Settings of White Leghorn and Australorp Eggs will be available from the State Research Farm, Werribee, during JULY, AUGUST, and SEPTEMBER.

Eggs from single-mated birds	**2 gns. a setting of 16**
Eggs from hens mated to pedigreed cocks ..	**1 gn. a setting of 16**



Apply to—

The Manager, State Research Farm, Werribee

The Journal of Agriculture

A VALUABLE Guide to improved farming practices and an essential aid to the solution of the many problems which confront the primary producer.

THE Journal of Agriculture contains interesting and informative articles written by expert officers of the Dept. of Agriculture and dealing with all phases of primary production.

The Journal records the results of the latest experimental and research work carried out on State and private farms and in the laboratory by the scientists of the Dept.

These articles constitute a valuable guide to improved farming practices and an essential aid to the solution of some of the many problems with which the producer is continually faced.

No agriculturist, grazier, dairy farmer, horticulturist, or poultryman can afford to disregard the help of the scientists and practical experts whose conclusions for practical application on the farm are recorded in the pages of this Journal.

Should you desire to have the Journal regularly each month, fill in the form below and forward it, together with cheque or postal note for 3s., to the Director of Agriculture, Melbourne, C.2.

The Director of Agriculture,
Melbourne.

Please forward the Journal of Agriculture to me monthly as published, beginning with the issue for the month of .....

I enclose cheque / postal note *for Three shillings to cover my subscription for one year.*

(Name).....

(Postal Address).....

.....

FRIESIAN BULL CALVES FOR SALE

The Victoria Stud, State Research Farm, Werribee

Herd Tested - Tuberculin Tested
Registered

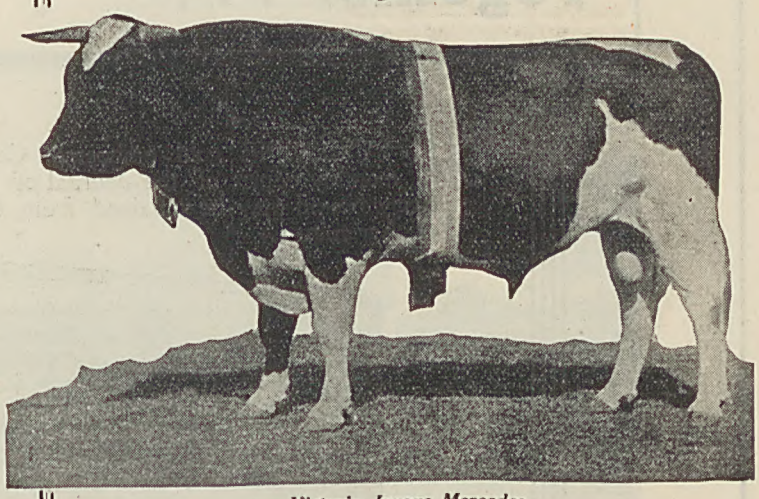
Sons or grandsons of the

Herd Sire

VICTORIA JOYOUS MERCEDES (985):

Champion, Melbourne Royal Show 1931 and 1933

Reserve Champion 1928, 1929, and 1934.



Victoria Joyous Mercedes

Dam:
Victoria Joybell, produced 15,387 lb. milk, 3·67 % test, 565 lb. butter-fat in 273 days, twice-a-day milking.

Daughters:
His eight (8) first-calf daughters have averaged 9,930 lb. milk, 3·73 % test, 370 lb. butter-fat in 273 days on first lactations.

INSPECTION -- INVITED --

1. **VICTORIA SIREN** (C.R.) *Born 3rd July, 1936*
Sire: Victoria Double Top (1354) *Dam:* Victoria Contralto (5106)
Victoria Contralto produced 305 lb. butter-fat in 240 days as Sr. 3 year old.
Price: **10 guineas** f.o.r. Werribee

2. **VICTORIA SINGING LAD** (C.R.) *Born 10th October, 1936*
Sire: Rupertswood Inka Jo. (1732) *Dam:* Victoria Songstress (3768)
Victoria Songstress produced 468 lb. butter-fat in 273 days.
Price: **17 guineas** f.o.r. Werribee

3. **VICTORIA VISCOUNT** (C.R.) *Born 24th October, 1936*
Sire: Rupertswood Inka Jo (1732) *Dam:* Victoria Joyous Piebe (3259)
Victoria Joyous Piebe has produced 546 lb. butter-fat in 273 days.
Price: **20 guineas** f.o.r. Werribee

4. **VICTORIA CONDUCTOR** (C.R.) *Born 13th January, 1937*
Sire: Rupertswood Inka Jo (1732) *Dam:* Victoria Soprano (3265)
Victoria Soprano produced 496 lb. butter-fat in 273 days.
Price: **17 guineas** f.o.r. Werribee

For further particulars apply to

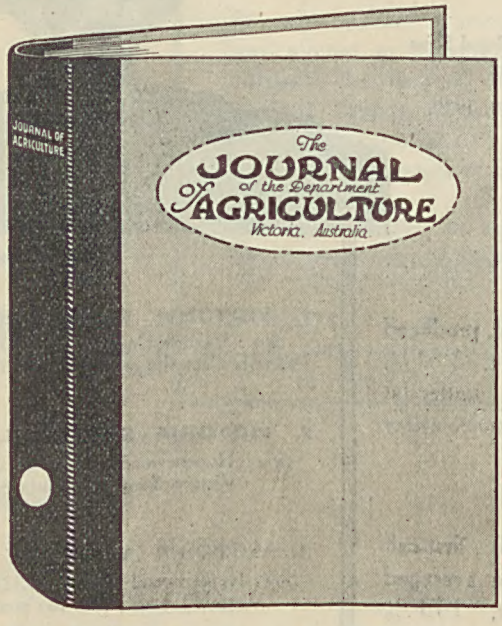
The Director of Agriculture, Melbourne,

or The Manager, State Research Farm, Werribee.

DEPARTMENT OF AGRICULTURE

Keep your Journals Together . . .

A HANDSOME gold-embossed Cover in which monthly copies of the Journal of Agriculture are easily bound may be obtained from the Department of Agriculture.



Made to hold 12 monthly copies and the annual index, this Cover will keep your Journals clean and in proper sequence and insure you easy and immediate access whenever reference is necessary.

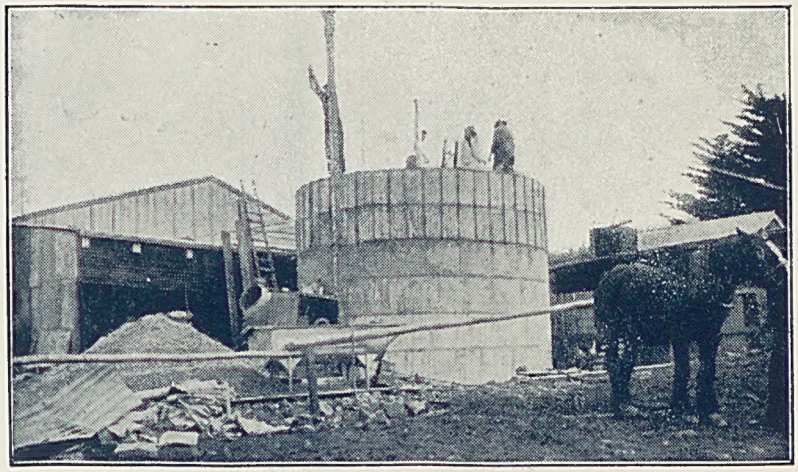
Price 1s. 6d. Post Free

Obtainable from the Director, Department of Agriculture

H. J. GREEN, Government Printer, Melbourne.

CONCRETE

For Hygienic Conditions and Permanent Satisfaction



Silo in Course of Construction
Concrete being placed and rammed in formwork
The roofing timber is used as pole for elevating concrete

USE

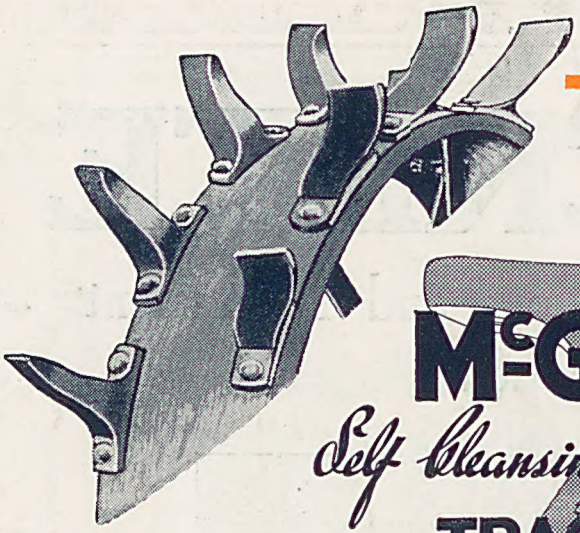
"ARC" Brand GEELONG Cement

Write to us for Free Booklet and Information
re Uses of Cement on the Farm

AUSTRALIAN CEMENT LIMITED

TEMPLE COURT, 422 COLLINS ST., MELBOURNE, C.1

Telephone : Central 1773 (4 lines)



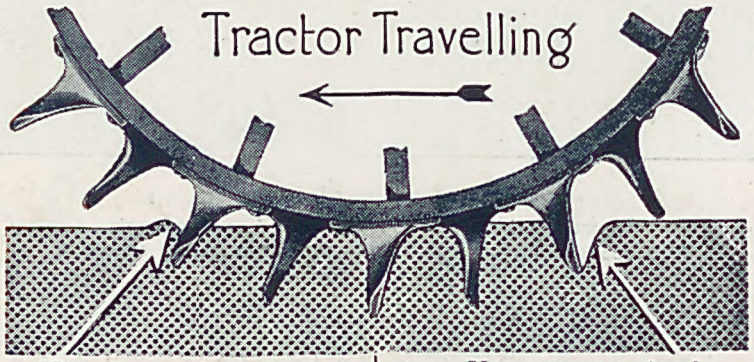
A Tractor is as Strong as its Grips!

McGREGOR

Self-Cleansing-Creeping-Wheel-offset

TRACTOR GRIPS

GIVE A PERFECT GRIPPING SYSTEM. NO BOGGING. NO SLIPPING. NO PACKING
ENSURE 100% EFFICIENCY AT THE DRAWBAR



Note forward push: The Grip when penetrating the soil slides forward on its concaved face, removing all resistance by its unique shape and set.

Note space gained between point of entry and exit. The Grip leaves the soil on its reverse face, being lifted—propeller like—by the turn of the wheel.

Stocks available in all States. Sold by every Reputable Tractor Distributor or Dealer.

Whether purchasing a new Tractor or re-equipping your old one,
INSIST UPON "McGREGOR" GRIPS

MANUFACTURED BY—

McGREGOR WHEEL GRIP & ENGINEERING Pty. Ltd.

67-75 RODEN STREET, WEST MELBOURNE

SP
630.5
V645